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Enabling disruptive technologies for higher education

Doctor of Education (EdD)

Educational Technology

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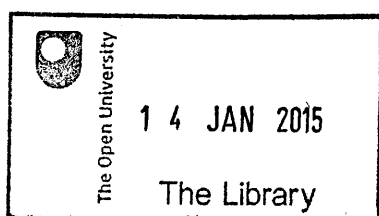
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Abstract

Higher Education Institutions (HEIs) in the UK have invested significantly in technologies for learning and teaching, especially technologies designed to support learning and teaching such as Virtual Learning Environments, which are more or less universal. However, technologies provided by HEIs have not been universally successful in terms of adoption and usage. Meanwhile, academic community members use non-institutional technologies, or “disruptive technologies,” to support their learning and teaching.

A number of researchers anticipated that the use of technology in learning and teaching would transform higher education. However, and to date, this has not happened. There is therefore a need to understand how non-institutional, disruptive technologies can be effectively incorporated into formal structures for supporting learning and teaching. In order to address this issue, this thesis set out to understand how HEIs in the UK can engage constructively with non-institutional technologies, using the concept of disruptive technologies as the primary analytical framework. The underlying aim was to establish whether non-institutional technologies can be effectively incorporated into HEI’s systems for supporting learning and teaching.

The thesis investigates these issues by carrying out a detailed analysis of practices of academic community members with non-institutional technologies used to support learning and teaching, over a period of two years. Data is gathered via surveys, interviews and observations. Study findings indicate that non-institutional technologies are used frequently to support learning and teaching in higher education, often in preference to institutional technologies. Study findings also indicate that non-institutional technologies can be effectively incorporated into learning and teaching if social and cultural practices around usage are clearly understood prior to incorporation.

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Undertaking this research has sometimes felt like plate spinning, seeking to keep a variety of things aloft at once. I have been an Associate Lecturer at the Open University (OU) since 2003. I had left university in 1999 with a PhD in nineteenth-century English literature and culture, and had thereafter (1999-2007) taught English at three HEIs and one private school. I had also had two books published in my field. In 2007 I started an MA in Online and Distance Education as part of my Continuing Professional Development at the OU. Undertaking the MA (2007-09) spawned my interest in disruptive technologies. In January 2009 I was appointed Head of Learning and Teaching at IFS University College, leading academic community development as the organisation sought taught degree awarding powers (granted in 2010). I started this EdD in May 2010, intending to use academic community members at the OU and IFS as research participants. My situation, however, became complex at the beginning of 2012, as I was offered the post of Head of Curriculum Innovation at King's College London, to the *chagrin* of the IFS. It has been a challenging few years. Incidentally, I am also a husband, and father to a son (15) and daughter (12, going on 19).

More positively, the research has resulted in a peer-reviewed journal article in *Research in Learning Technology* (Flavin, 2012) and a further peer-reviewed journal article in *Innovations in Education and Teaching*

International (Flavin, 2013). The research has also led to peer-reviewed conference presentations at The University of Brighton (2011), University of Oxford (2012), University of Manchester (2012), and University of Plymouth (2013), with a further, accepted paper to be presented at the University of Sheffield (January 2014). Furthermore, my blog supporting the research, www.idcharred.wordpress.com, has had over 12,000 hits. Collectively, these products of the research have been good for morale, and the published articles suggest that the research is of interest to a wider constituency.

I therefore wish to acknowledge the first supervisor, Dr Daisy Mwanza-Simwami, and the second supervisor, Prof Denise Whitelock. I also wish to acknowledge the initial second supervisor, Prof Chris Jones. Furthermore, I wish to acknowledge additional support from Prof John Richardson. Moreover, I am grateful to support from colleagues at King's College London, most notably Prof Paul Blackmore, and am further grateful to the research participants who participated in the study as a whole.

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CHAPTER 1: THESIS OVERVIEW

1.1 Introduction

This chapter provides an introduction to the research work presented in this thesis. It describes the research background and explains the motivation for pursuing this work. In addition it provides an overview of the approach taken. Finally, it introduces the structure of the thesis.

1.2 Motivation for this research

Various technologies are currently used to support learning and teaching in higher education, from institutional systems such as Virtual Learning Environments (VLEs) to non-institutional systems, including internet search engines and online encyclopaedias. Indeed, it is a contention of this research that non-institutional technologies are used widely by academic community members within higher education institutions (HEIs), often in preference to institutional technologies. The situation whereby a new technology or innovation takes over functions of a traditional or established technology has been described by Christensen (1997) as “disruptive technology,” later amended by Christensen and Raynor (2003) to “disruptive innovation.” The thesis discusses these two key terms in detail in section 1.3. The technology

usage situation in UK HEIs, and Christensen's introduction of the notion of disruptive technologies, inspired the conception of this research to investigate the extent to which disruptive technologies are used to support learning and teaching in UK HEIs, and to examine how HEIs can engage constructively with disruptive technologies.

The research seeks to understand how disruptive technologies are currently used to support learning and teaching in higher education. The thesis identifies a number of non-institutional technologies that are being used by academic community members in UK higher education and examines how these technologies are being used to support learning and teaching. Specific technologies examined in this thesis include the internet search engine Google, and the online encyclopaedia Wikipedia, both of which conform to Christensen's (1997) definition of disruptive technologies (see below).

1.3 Definition of Key Terms

A number of specific terms are used in this thesis, drawn from theories of learning and from theories relating to other areas of human practice. Specific, relevant terms that are used in this thesis are discussed below.

1.3.1 Disruptive Technologies

The term “disruptive technologies” is a key term in this thesis, having a special meaning that draws from Christensen’s (1997) work. *Use of the term disruptive technologies has been adopted in this thesis to refer to technologies that are not traditionally designed to support learning and teaching, and that have not been formally introduced by HEIs, but are being used by members of the academic community to support learning and teaching.* More precisely, disruptive technologies conform, to the four criteria identified by Christensen (1997, p.xv), in that they are cheaper, simpler, smaller and more convenient to use.

Disruptive technology is the term used by Christensen (1997) in a dualism he constructs between sustaining technologies and disruptive technologies. Sustaining technologies allow us to do something we had already been doing a little bit better than before (for example, a slightly more fuel efficient car), whereas the latter prompt new forms of practice and, moreover, frequently displace a previously dominant, incumbent technology.

Christensen and Raynor (2003) revised the term disruptive technology to Disruptive Innovation. Their reason for so doing was to highlight the argument that the disruption is not an intrinsic feature of the technology but, instead, emerges through practice. Consequently, Disruptive Innovation is now the more widespread term. That said, this thesis makes use of the

disruptive technology term, too, because the thesis is fundamentally about technologies to support learning and teaching. Therefore, an individual technology can be a disruptive technology, while the wider, theoretical approach to technologies laid out by Christensen and subsequently others is better phrased as Disruptive Innovation. Consequently, when this thesis refers to disruptive technology it is customarily referring to individual technologies, whereas when this thesis uses Disruptive Innovation, the thesis is referring to Christensen's wider theory.

It can be argued that a range of technologies can, consequently, be defined as disruptive technologies, for example email or the calculator. Both would undoubtedly qualify as disruptive technologies. However, both are fully established, and adhere more closely to the sustaining technology model, as they improve incrementally through enhanced functionality, appealing to an existing customer base. This thesis is more interested in disruptive innovation impacting now on higher education in the UK, reshaping aspects of learning and teaching practice contemporaneously.

Further discussions around this term are presented in chapter 2, section 2.3.

1.3.2 Activity Theory

This thesis also uses Activity Theory and expansive learning as a lens through which to examine the impact of disruptive technologies on higher

education learning and teaching. The former, Activity Theory, a framework for analysing purposeful human activity, was conceptualised by Leontiev (1978, 1981) following ground work by Vygotsky (1927/1997, 1930/1938). The latter, expansive learning, was devised by Engeström (1987, 2001), whose work was informed significantly by Activity Theory which provided the original, triadic representation of purposeful human activity, upon which Engeström expanded by adding additional social elements to the original formulation. References to Activity Theory in this thesis allude to the original theoretical work on human activity and consciousness, with particular reference to the argument that subjectivity is historically and socially determined. References to second generation activity theory allude to Engeström's specific framework for understanding purposeful human conduct and its attendant social relations. Engeström states that the contradictions within an activity system can result in expansive learning, leading to the creation of a new activity system (Engeström 1987, 2001).

Engeström (in common with Activity Theory) uses the term "subject" to denote a human participant or human participants. Engeström uses "tool" to refer to real or symbolic artefacts. In this thesis, "tool" refers to technology, in the sense of an artefact used to accomplish a purpose. Within an activity system, the term "object" is used to denote purpose. Consequently, within this thesis, subjects refer to participants, tools refer to technologies accessed via the internet, and object signifies purpose.

1.3.3 Academic Community Members

This research defines an academic community as a Community of Practice (Lave and Wenger 1991; Wenger, 1998). An academic community comprises a range of roles contributing to learning and teaching. Inevitably, some roles within the community are more impactful than others (a lecturer is likely to have more explicit impact on learning and teaching than a learning technologist), but those on the periphery of a community of practice can have significant impact by, for example, introducing a new technology to an academic community (Jewson, 2007b, p.73; see also chapter 2, section 2.6). Consequently, while the bulk of the research participants are lecturers or students, a smaller number work in academic-related roles, in order to reflect and articulate the notion of an academic community as a community of practice.

In addition, this thesis refers to learning and teaching to describe a pedagogical totality. More specifically, this thesis does not demarcate between learning and teaching and examine each separately, because, and in order to reinforce the Community of Practice perspective, a range of roles are seen to be contributing to collective, institutional aims.

1.4 The purpose of this thesis

The purpose of this thesis is to understand how HEIs in the UK can engage constructively with disruptive technologies for learning and teaching. The thesis seeks to realise its purpose by investigating the extent to which disruptive technologies are used to support learning and teaching in UK HEIs. The thesis further seeks to understand how disruptive technologies are currently used to support learning and teaching in higher education. In addition, this thesis examines the implications of disruptive technology use for learning, teaching and social relations in higher education. The research argues that HEIs can engage constructively with disruptive technologies by, in the first instance, recognising the ways academic community members actually do use technologies to support learning and teaching.

1.5 Research Aims and Objectives

The overall aim of this research is to better understand how HEIs in the UK can engage constructively with disruptive technologies for learning and teaching, in order to enable the more effective use of disruptive technologies in learning and teaching in UK higher education. The essence of this view is that various types of technologies are used to support learning and teaching in UK HEIs including technologies that are not traditionally designed for learning. Therefore, the research argues that HEIs need to recognise this situation and understand how and why these alternative technologies are

being used, in order to inform their policies around technology integration and use in higher education.

In order to fulfil this research aim, the thesis explores the following objectives.

- 1) To establish whether or not academic community members use disruptive technologies to support learning and teaching.
- 2) To identify disruptive technologies that academic community members use to support learning and teaching.
- 3) To understand how academic community members use disruptive technologies to support learning and teaching.

1.6 Thesis Contributions

This thesis identifies significant features of academic community members' practices with technologies to support learning and teaching. The thesis also explores the implications of disruptive technology use, with the use of non-institutional technologies impacting, potentially, assessment and the division of labour in higher education.

The thesis challenges the argument that academic community members use a plethora of technologies to support learning and teaching (see, for

example, Prensky, 2001) and, instead, argues that academic community members use a small range of technologies to accomplish a wide range of tasks.

The research as a whole offers a new critical perspective on technology enhanced learning by using a range of approaches to investigate the uses of technologies to support learning and teaching in higher education. Furthermore, while previous works on Disruptive Innovation in relation to education (Christensen *et al.*, 2008; Christensen and Eyring, 2011) have taken a macro approach, looking at how Disruptive Innovation can impact upon education systems, this research is focused on micro level disruptive innovation, examining how individual technologies and the use thereof can shape learning and teaching in higher education. The implications of this research for higher education systems are discussed, but the focus rests more closely on the presence and impact of disruptive technologies in individual learning and teaching situations. The conjoining of Disruptive Innovation with Activity Theory and expansive learning means that disruption is not merely observed, but analysed, too.

The research argues that a narrow range of technologies is currently used to support learning and teaching, with, for example, Google being used as a hub technology, from which a range of resources are accessed, including open educational resources. Furthermore, the results of the research suggest that technologies are used disruptively in the sense defined by Christensen, as non-institutional technologies are used widely, and technologies that are

simple, cheap (generally free), convenient and easy to use often result in successful adoption (Christensen, 1997, p. xv). In addition, this research argues that, alongside institutional and non-institutional technologies, there are emerging quasi-institutional technologies, meaning technologies that are fundamentally non-institutional, but which are being appropriated by institutions for the purpose of learning and teaching. The specific example cited in this thesis to illustrate the category is university You Tube channels. The research also claims that participants are not using social networking technologies to a significant extent to support their learning and teaching.

The final part of the thesis speculates on means by which to enhance learning and teaching in higher education by accommodating the use of disruptive technologies, recognising that academic community members often by-pass institutional resources in their construction of knowledge. The thesis thereby encourages constructive engagement with disruptive technologies by focusing on actual practice.

The research is of interest because it identifies and explores misalignments between the technologies supplied by HEIs, often at considerable expense, and the technologies used in practice by academic community members. In addition, the research is of interest because it shows how academic community members access knowledge resources without mediation through their HEI. This practice has implications for the division of labour in higher education, for assessment, and for the higher education community as a whole. Furthermore, the research argues that the use of disruptive

technologies can challenge the role of the HEI as gatekeeper to knowledge. The research is also of interest because it claims that an approach to technology enhanced learning based on actual practice, rather than on the technologies themselves, is likely to be more fruitful in terms of enabling and encouraging engagement with disruptive technologies to support learning and teaching.

In order to explore issues raised in these discussions, the following main research question and sub-research questions were formulated to inform the investigation.

1.7 Main Research Question

The main research question that this research is focused on is:

How can HEIs in the UK engage constructively with disruptive technologies for learning and teaching?

It is clear that the use of technologies to support learning and teaching in higher education in the UK is widespread, even ubiquitous (Britain and Liber, 2004; Kinchin, 2012; UCISA, 2012). This could be, at the most mundane level, the use of mobile phones to alert students to room changes

or lecture time changes. However, the use of institutional technologies such as academic journal aggregators is less widespread, and the use of VLEs is often limited, relative to VLEs' design features and potential (Blin and Munro, 2008; Fry and Love, 2011: both pairs of researchers found VLEs used as content repositories, rather than as a channel for interactive learning and teaching). Instead, as this research argues, academic community members make extensive use of non-institutional, frequently disruptive technologies to support their learning and teaching. There is therefore a need to understand more fully the actual technology practices of academic community members, with a view to rethinking institutional approaches to technology enhanced learning, being more cognizant of the ways in which academic community members actually do use technologies. Consequently, strategies for technology enhanced learning can be informed by actual practice, rather than determined by technology.

A set of sub-research questions were used to aid the exploration of the main research question (see below).

1.7.1 Sub-Research Questions

In order to investigate the main research question in more detail, a series of further questions were necessary to examine various aspects of technology usage in higher education learning and teaching. Specific, sub-research questions addressed in this study are as follows:

- What technologies are being used to support learning and teaching in Higher Education, and how are they being used?
- Are disruptive technologies being used to support learning and teaching in Higher Education in the UK?
- Are users utilising established technologies in disruptive ways?
- How is the disruptive use of technologies impacting on Higher Education in the UK?

Addressing these questions enables consideration of the presence and effectiveness of disruptive technologies in supporting learning and teaching, as illustrated in the various chapters of this thesis outline.

1.8 Thesis Structure

This thesis is organised as follows.

Chapter 1 presents an overview of this thesis which introduces the research that was carried out. The motives for carrying out this research are also discussed, highlighting Christensen's (1997) seminal work and introducing the concept of disruptive technologies which, together with the realisation that academic community members use disruptive technologies, served as the main inspiration for pursuing this research.

Chapter 2 surveys literature around technology use in UK HEIs and presents, in more detail, the theoretical approach underpinning this research, namely the notion of disruptive technology (Christensen, 1997) and Disruptive Innovation (Christensen and Raynor, 2003); Activity Theory (Leontiev, 1978; 1981), second generation activity theory (Engeström, 1987; 1999b; Daniels, 2008) and the Community of Practice (Lave and Wenger, 1991; Wenger, 1998). The hierarchy of the frameworks is reflected in the review. Therefore, most attention is given to the work of Christensen and others around disruptive technology and Disruptive Innovation, and secondary attention is given to Activity Theory and expansive learning, a perspective which is used to analyse the impact of the technologies identified as a result of the Disruptive Innovation approach. Finally, a shorter section on the Community of Practice theory is used to establish what is meant by academic community members in the context of this research.

The concept of disruptive technology is the key focus of study in this thesis and used to frame UK academic members' use of non-institutional technologies to support learning and teaching. It is argued that UK HEIs can devise strategies for technology enhanced learning based on actual practices with technologies to support learning and teaching, rather than have strategies determined by technology itself. The research uses second generation activity theory (Engeström, 1987, 1999b, p.31; Daniels, 2008), as a lens through which to consider the impact of disruptive technologies on UK higher education (second generation activity theory is discussed in

chapter 2, section 2.4). Finally, the thesis uses the Community of Practice (Lave and Wenger, 1991; Wenger, 1998) to analyse the structural composition of academic communities.

Chapter 3 looks at the study design, including ethical and data protection issues. The chapter describes the research design and outlines the methodology used to gather and analyse research data. Research was conducted in seven phases with academic communities members of HEIs in the UK over a period of two years. A mixed methods approach to gathering and analysing research data was applied using various types of research instruments to gather both quantitative and qualitative data (primarily the latter). The research instruments used to gather data included surveys, interviews with individual study participants, and observations. Techniques used to analyse data included: defining categories according to selected labels drawn from the underlying theoretical framework, classifying data and observations according to the developed categories, identifying matching patterns of technology usage, identifying contradictions (historically accumulating structural tensions in activity systems [Engeström, 1987, 1999a, 200]) in relationships between academic community members and technology usage mechanisms, and examining the effects of conditions, rules and cultural norms that exist in the contexts in which technology is used to support learning and teaching, to establish whether there are conflicts.

The research instruments used in this thesis have been used in previous studies deploying Activity Theory as an analytical lens. For example, Scanlon and Issroff (2005) used observations in their examination of how technologies are affecting learning and teaching relationships in higher education, and Kirkup and Kirkwood (2005) used Activity Theory in interviews with lecturers on their uses of technologies to support students' learning. Furthermore, Mwanza-Simwami (2013) and Mwanza (2002, 2011) used observations in conjunction with interviews in a work based study underpinned by Activity Theory, and Langemeyer (2006) used interviews of work based learners in an Activity Theory driven study. Moreover, Jelfs and Whitelock (2001) used Activity Theory in an exploration of how students use VLEs. In addition, Hardman (2005) used Activity Theory to analyse the impact of technology in teaching mathematics in deprived communities in South Africa, and Murphy and Rodriguez-Manzanares (2008) reviewed studies that used Activity Theory to analyse Information and Communication Technologies in educational contexts.

Chapter 4 discusses the pilot study, which comprised a survey, to gather data on the awareness and usage of technologies, and, moreover, to help influence the approach taken in further iterations of the research. The pilot study suggested that participants were well aware of established technologies capable of supporting learning and teaching, but less well aware of emerging technologies. Furthermore, the pilot study showed that awareness of technologies did not correlate with usage of technologies. In addition, the pilot study indicated that other research instruments would be

necessary to produce richer data on how academic community members find or create purposes for specific technologies.

Chapter 5 commences with two, follow-up, semi-structured interviews from the pilot study sample, in order to gain richer qualitative data (Phase I). Phase II of the research, also featured in chapter 5, comprised a further survey, modified from the pilot study survey. The final section of the chapter consists of two follow-up interviews with the same participants interviewed after the initial survey, comprising Phase III of the research. The chapter indicated that purposes for technologies are produced from usage, as argued for by Christensen and Raynor (2003).

Chapter 6 describes the further investigations that were carried out around academic community members' use of disruptive technologies, by conducting observations of practice in the context in which technologies are used. Having previously focused on participants' declared practice with technologies to support learning and teaching, chapter 6 looks at actual practice. These observations were supplemented by carrying out structured interviews (Phase V) in a follow-up investigation that also included the implementation of a final survey (Phase VI). These investigations were designed to iteratively build upon previous studies conducted in earlier phases so as to establish whether participants were using a plethora of technologies or demarcating technology use, as the research sought to better understand the disruptive use of technologies.

Chapter 7 discusses the study findings, informed by the research undertaken and by the underpinning theoretical approaches. The chapter engages with both the main research and sub-research questions, and argues that academic community members demarcate in their uses of technologies, using a small number of tools (generally non-institutional) to accomplish a wide range of objects, and constructing purposes for tools through their usage of them, in line with Christensen and Raynor (2003).

Chapter 8 provides an overview of the research and describes what has been achieved in this thesis. Suggestions for future research are presented, and the implications of the research discussed. It is argued that HEIs would benefit from engaging with disruptive technologies, recognising that disruptive technology use happens, and that an accommodating approach, based on known aspects of practice, will enable disruptive technologies to contribute to and enhance learning and teaching in UK higher education.

1.9 Conclusion

Having provided an overview of the thesis and the rationale for the research, the next chapter goes into more depth in terms of analysing the literature underpinning and informing the research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature relevant to an examination of the use of disruptive technologies in UK higher education, in order to underpin and inform the core research question of better understanding how HEIs can engage constructively with disruptive technologies for learning and teaching. The chapter first reviews literature around technology use in UK higher education. Thereafter, the chapter introduces the key approaches used to explore the investigations reported in this thesis.

To start with, Christensen's work on disruptive technologies and innovations is outlined and reviewed to explicitly and implicitly evaluate the impact of disruptive technology use on learning and teaching in UK HEIs. Thereafter the thesis discusses Activity Theory (Leontiev, 1978, 1981) and second generation activity theory as illustrated in Engeström's (1987, 2001) theory of expansive learning. Activity Theory is used in the thesis to investigate both the subject node in an activity system and, more particularly, the significance of tools as mediators of human action. In addition, the Community of Practice theory is reviewed, since work by Lave

and Wenger (1991) and Wenger (1998) assists with the understanding of an academic community.

Therefore, the three, theoretical frameworks used in this research are as follows, in order of significance:

1. Disruptive technology (Christensen, 1997) and Disruptive Innovation (Christensen and Raynor, 2003).
2. Activity Theory (Leontiev, 1978, 1981) and second generation Activity Theory based on the theory of expansive learning (Engeström, 1987, 2001).
3. Community of Practice (Lave and Wenger, 1991; Wenger, 1998).

These approaches are used to address the core research question of understanding how HEIs in the UK can engage constructively with disruptive technologies for learning and teaching, and to address the sub-research questions relating to the practicalities of disruptive technology use to support learning and teaching.

In the sections that follow, each of the three frameworks listed above is reviewed in detail. Thereafter, a summary of key points for exploration in this thesis is given. In addition, consideration is given to how each links to the core research question.

2.2 Technology use in UK higher education

The use of technologies to support learning and teaching in UK higher education is widespread, indeed universal. For example, VLEs are established features of HEIs' provision, and academic community members use the internet extensively to undertake research (Britain and Liber, 2004; Kirkup and Kirkwood, 2005; Browne *et al.*, 2006; Conole *et al.*, 2008; Kinchin, 2012; UCISA, 2012). However, this research argues that the use of institutional technologies to support learning and teaching in higher education is less prevalent than the use of non-institutional technologies. By way of a specific instance, this research will argue that academic community members are more likely to use Google and Wikipedia than an institutional, academic journal aggregator. Technology use in UK higher education is extensive, but is weighted towards non-institutional sources, a practice which has implications for learning and teaching, as resources are being selected from sources other than the HEI, and not mediated by the HEI.

A number of researchers anticipated that the use of technology in learning and teaching would, "transform and disrupt teaching practices in higher education" (Blin and Munro, 2008, p. 475; Sharples, 2002). Moreover, and in design terms, VLEs have the potential to transform learning and teaching, as they can enable any time anywhere peer collaboration through their discussion facilities. However, discussion facilities on VLEs are often

underused and, instead, VLEs are more commonly used as content repositories (Blin and Munro, 2008; Fry and Love, 2011). Far from changing pedagogical practices, VLEs have reaffirmed traditional, transmissive modes of teaching, as Blin and Munro (2008) found in their study (conducted, admittedly, in the Republic of Ireland rather than the UK). Moreover, Hemmi *et al.* (2009) argue, “The currently dominant modes for e-learning within higher education – those enabled by commercial virtual learning environments (VLEs) – are generally failing to engage with the rich potential of the digital environment for learning” (p.20). There is a gap between the design features of a VLE and the customary use of a VLE in practice.

This thesis, using Christensen’s research as its primary perspective, suggests that VLEs are sustaining technologies, offering improvements in terms of access (a VLE allows students to access content any time, not just at the timetabled slot) but not changing the relationships operating in learning and teaching. That said, if VLEs work well as content repositories, as is seen in the cases of individual students surveyed in Conole *et al.* (2008), then there is an argument for using VLEs in precisely this way. In line with the nuanced version of Disruptive Innovation posited by Christensen and Raynor (2003), practice creates purpose and VLEs are often used, in practice, to store and access content (Blin and Munro, 2008).

Students may be making limited use of VLEs, but evidence suggest they are enthusiastic users of technology more widely in their lives, with Madge *et*

al. (2009), claiming over 95% of UK students are regularly using social networking sites. However, out of the 213 students sampled in their research on the use of the social networking site Facebook, less than 10% were in favour of Facebook being used as a teaching tool. Similarly, Jones *et al.* (2010) found that, while over 70% of their sample (drawn from four universities) had a social networking account, they rarely used social media for educational purposes. Students, therefore, seemingly prefer to demarcate their technology usage, an argument also made by Timmis (2012), and reinforced in this research.

In addition, it is easy to make assumptions about students as users of technologies. Prensky (2001) constructed the dualism of digital natives and digital immigrants to define the space between a generation of students who had grown up with digital technologies, and prior generations of teachers to whom the technologies were unfamiliar. However, subsequent, empirical research has painted a very different picture. Jones and Healing (2010), for example, interviewed first year undergraduate students in England and found that over a third of the interviewees were not confident about using VLEs (p.349). That said, the same article quoted one student praising the VLE in its content repository role, as “a central thing for everything, a central source” (p.350). Other research has also shown students to be largely passive users of technologies (Kirkwood, 2008; Margaryan *et al.*, 2011), while Jelfs and Richardson (2013) found no evidence to support the digital natives hypothesis, in a survey of more than 4,000 distance learners in higher education. Therefore, there may not be a significant gap between

individual sub-communities within a wider academic community in terms of technology usage to support learning and teaching.

Existing research suggests, therefore, that VLEs are used widely, but that their full range of learning and teaching potential is seldom realised. Moreover, students are likely to be fulsome users of some social networking technologies, but may not necessarily want to use these technologies to support learning and teaching. Design may enable technologies to perform a range of functions, but (and as this thesis argues) practice determines purpose, and this research is concerned fundamentally with practice. Technologies are used widely in UK higher education in the sense that technology is used to facilitate and support learning and teaching, but not all individual technologies are used widely, and indeed usage of individual technologies is (this thesis argues) circumscribed by users who determine specific and distinctive purposes for specific technologies.

In order to examine issues raised in these discussions, the thesis introduces and works with Christensen's concept of disruptive technologies to frame UK academic community members' use of technologies that are not formally introduced by institutions for supporting learning and teaching, but that have been shown to be useful in this area.

2.3 Disruptive Technology

This section summarises Christensen's work on disruptive technology and Disruptive Innovation and also illustrates how other writers have commented on and critiqued Christensen's work. The survey is undertaken in order to produce a more nuanced reading of disruptive technology and Disruptive Innovation to inform the research and analysis undertaken in the thesis.

One way of viewing technologies, a view advocated by Christensen (1997), is to distinguish between technologies that enable us to do something we had already been doing a little better than before (sustaining), and technologies that result in a new form of practice (disruptive).

Disruptive technologies disrupt established practices, often starting with a small number of users, but growing over time to the extent that they displace a previously dominant, incumbent technology. Conversely, sustaining technologies enhance the performance of established technologies:

What all sustaining technologies have in common is that they improve the performance of established products... Disruptive technologies bring to market a very different value proposition than had been available previously... Products based on disruptive technologies are typically cheaper, simpler, smaller, and, frequently, more convenient to use. (Christensen, 1997, p. xv)

Subsequently, Christensen *et al.* offered a synoptic description of disruption as “the process by which an innovation transforms a market whose services or products are complicated and expensive into one where simplicity, convenience, accessibility, and affordability characterize the industry” (2008, p. 11). Specific examples cited by Christensen *et al.* (2008) include the Sony transistor radio (see below).

Christensen and Raynor (2003) changed the term “disruptive technology” to “disruptive innovation”, arguing that the disruption is not an intrinsic feature of the technology, but, instead, emerges through practice. However, the term “disruptive technology” continues to be used in this thesis for clarity’s sake, as the research is fundamentally focused on technologies for learning and teaching. Therefore, while Disruptive Innovation is used to signify the wider framework, disruptive technology is used in relation to specific technologies that are disruptive.

Christensen *et al.* (2008) argue that the education system in the USA has relied on sustaining technologies, and Christensen and Eyring (2011) claim that higher education in the USA has also followed the sustaining technology approach: “Even when computers were introduced into the classroom, they were used to enhance the existing instructional approaches, rather than to supplant them. Lectures, for example, were augmented with computer graphics, but the lecture itself persisted in its fundamental form” (p. 18). In this sense, Christensen’s argument repeats the findings of Blin and Munro (2008) in their study of a VLE at a campus university in Ireland.

Where Blin and Munro conclude, “although use of the VLE is widespread within the university, little disruption of teaching practices... has occurred” (p. 488), Christensen *et al.* argue, “traditional instructional practices have changed little despite the introduction of computer and other modern technologies” (2008, p. 83).

Typically, disruptive technologies first acquire a constituency from non-consumers of a related product or service (Christensen *et al.*, 2008, p. 74). Christensen *et al.* supply an example in the form of Sony: “in 1955, Sony introduced the first battery-powered, pocket transistor radio. In comparison with the big RCA tabletop radios, the Sony pocket radio was tinny and static-laced. But Sony chose to sell its transistor radio to nonconsumers – teenagers who could not afford a big tabletop radio.” Therefore, “because Sony deployed the transistor against nonconsumption, all it had to do was make a product that was better than nothing” (2008, pp. 80-81). Furthermore, the product was affordable to a constituency who could not afford radios before (teenagers), thereby helping to produce new forms of broadcasting practice, as programmes were made to appeal to the newly-enfranchised community. Applying this general principle analogously to higher education, if technology can make learning easily available to people who don’t currently have easy access to higher education, then the quality and extent of the education offered will be less significant than the fact that it is being offered at all. Minority communities and developing countries may not have easy access to higher education, but technology can make it available to anyone with access to a networked device and thus the

technology has disruptive potential. It is not the aim of this research to explore the potential of disruptive technologies to widen access to higher education, though some research has been undertaken in this area (e.g., Koszalka and Ntloedibe-Kuswani, 2010). Instead, this research is focused on understanding how HEIs can engage constructively with disruptive technologies in Higher Education, and Christensen *et al.* (2008) (and Christensen [1997]) argue for the specific conditions best suited to the adoption of a disruptive technology.

Disruption works, not by confronting established practice, but by offering something new, and frequently by offering a technology to a previously disenfranchised community: Christensen *et al.* state, “A major lesson from our studies of innovation is that disruptive innovation does not take root through a direct attack on the existing system. Instead, it must go around and underneath the system” (2008, p. 243). Therefore, applying technology enhanced learning within established pedagogic models can be problematic, because the technology gets contorted to suit the existing pedagogy, and thus only a small portion of the learning and teaching potential of the technology is realised. The technology confronts an existing pedagogical model and gets consumed by it. Therefore, and in order to utilise the full potential of technology enhanced learning, HEIs need to observe what technologies can do, what academic community members actually do with technologies and align these practices with course content, assessment and delivery. As part of its methodology, this research aims to record actual

practices with technologies to support learning and teaching, in order to claim that technology enhanced learning strategies based on actual practice are more likely to succeed.

Govindarajan and Kopalle (2006) develop Christensen's framework by drawing a distinction between radical innovations and disruptive innovations. The former refers to the emergence of a new technology, whereas the latter "refers to the extent an emerging customer segment... sees value in the innovation at the time of introduction, which over time disrupts the products mainstream customers use" (pp.13-14). Therefore, radical innovations are about technologies, whereas disruptive innovations are about practice and market behaviour. Govindarajan and Kopalle conclude that enabling disruptive innovations presupposes some risk-taking, and some failure, a conclusion also drawn by Hamal and Prahalad (1991). Therefore, successful disruptive innovations emerge from practice. Consequently, identifying disruption is essentially reactive (echoing Christensen's [2006] analysis, that "data exists only about the past" [p. 41]), monitoring usage trends to identify the meanings users create for themselves. Disruptive Innovation is not a predictive theory, a view also taken by Danneels (2004, 2006). That said, a contrary argument can be constructed, as Christensen's core criteria for disruptive technologies (1997, p.xv) can be used to identify technologies that are likely to succeed. Govindarajan and Kopalle construct disruption as a process of trial and error, but Christensen (1997) gives some guidance regarding the qualities

disruptive technologies should have if they are to succeed, qualities which are evident in some technologies studied for this research.

Moore (2004) also argues for different categories of disruption. He claims that disruptive innovation “tends to have its roots in technological discontinuities, such as the one that enabled Motorola’s rise to prominence with the first generation of cell phones, or in fast-spreading fads like the collector game Pokémon” (p. 88). Moore’s argument aligns with Christensen’s original formulation of disruptive technology (1997), but his mention of fads hones in usefully on the idea that not all disruptions are sustainable, nor is disruption good axiomatically, a point also made by Benson and Whitworth in relation to Activity Theory (2007); they argue that contradictions within an activity system may need to be understood rather than eradicated (p.79). Disruption is a form of practice, and how it develops depends on how communities create a purpose for a disruptive technology. However, this is not an organic process, as external factors such as marketing (see Markides, 2006) can shape a community’s, and an individual’s, response to a technology.

Moore comes up with another category, Application Innovation, and supplies the example of how “Tandem applied its fault-tolerant computers to the banking market to create ATMs” (p.88). This is very close to Christensen and Raynor’s Disruptive Innovation (2003), which sees

disruption arising from practice rather than design. Fault tolerant computers were not designed *a priori* to enable ATM machines, but found a valuable purpose in that area of industry. Moore's use of Application Innovation suggests that innovation can be a conscious process (at the application if not the design stage), whereas Christensen and Raynor (2003) see innovation as more serendipitous, arising out of practice.

While Moore looks to sub-divide disruption, Markides (2006) argues that disruption can occur through planning as well as through practice. Markides develops Christensen's work by also identifying sub-categories of innovation, including disruptive business-model innovation, and disruptive product innovation. Disruptive business-model innovations attract new customers, or persuade existing customers to consume more (p. 26). For example, Amazon and Swatch are business-model innovators, as they introduced new business models that attracted new customers: "Amazon did not discover bookselling; it redefined what the service is all about, what the customer gets out of it, and how the service is provided to the customer" (p. 20). Markides also argues that business-model innovations gain a certain percentage of the market, but do not remove incumbents (p.21), an analysis which contradicts Christensen's. He cites the case studies of internet banking and no frills airlines to support his view, both of which exist alongside their predecessors. For Markides, disruption can be created by astute marketing redefining practices. In this sense Markides's reading of

disruption is distinctive, because he argues it can be created consciously and through pre-planning.

Regarding disruptive product innovations, Markides claims that “they introduce products and value propositions that disrupt prevailing customer habits and behaviours in a major way” (p. 22). He gives the car and mobile phones as examples. He further argues that these innovation are not, in general, driven by demand, but from “a supply-push process” (p.22), which aligns with Christensen, who sees the disruption arising from subjects’ (individuals’) interactions with new technologies, leading to new practices disrupting established markets. The market in this model of innovation “remains remarkably fluid throughout most of the early years, and many more firms come and go than are left operating in the market when its structure finally settles down” (p. 23). In terms of who prospers and who fails, Markides argues that successful participants time their entry into the market (whereas Christensen *et al.* [2008] in their case study of the Sony transistor radio suggest it is more serendipitous), develop strong brands, control the channels of distribution, and thus build a niche into a mass market. For example, in learning and teaching (and in other areas of practice), Second Life was innovative yet, despite widespread publicity, did not gain a substantial foothold in learning and teaching as, in practice, it was not used extensively and was unable to build a sustainable niche in higher education (Livingstone, 2011); an OECD study (2009, p.15) found that less than 9% of students used Second Life or other virtual worlds (though the

study looked at US rather than UK students). A similar failure was experienced by the Stanford Centre for Research, Development and Teaching which was technologically advanced for its time, but led by technology rather than practice (Cuban, 2001, pp. 99-101) and, again, proved to be an unsustainable innovation. Christensen *et al.* (2008) argue that disruptive innovations become sustaining innovations over time, but are disruptive at their point of entry into a market, and establish their niche (sustainable, over time) through their disruptive features.

Markides's most significant contribution to Disruptive Innovation is to help steer understandings of innovation away from ideas of unfettered, spontaneous creativity, and towards an understanding of innovation as structured and planned within existing market practices and behaviours, and thus malleable through effective product development and marketing. This is relevant to the research because some aspects of the research, for example the observations, suggested that participants had favourite technology brands.

It is evident that one of the core tenets of disruptive technology and Disruptive Innovation is that purpose emerges from practice. Users construct a meaning for a technology, which may differ from the designer's original intentions. Smagorinsky (2001) allows for the development of this argument by exploring factors that influence the construction of meaning.

He argues that the construction of usage and therefore meaning is not an unfettered process and, instead, is shaped by pre-existing power structures in a given society (p. 136). In practice, in learning and teaching situations, “teachers emphasise specific reading conventions and discourage others” (p.138). Consequently, socio-economic groups socialised within the dominant culture have an educational advantage, as their values and practices have already been constructed and reaffirmed by dominant culture. Extending this argument to technology use in educational settings, it has parameters and limitations. Smagorinsky argues that the possibilities of meaning are not limitless, but are shaped by subjects’ (individuals’) historical and cultural inheritance, an argument which aligns with Vygotsky (1930/1998; see below, section 2.4).

For Smagorinsky, meanings constructed are, in turn, shaped by history, in the sense that existing possibilities for the use of a technology will have been constructed by previous societies, thereby comprising a range of established uses. Smagorinsky’s understanding of knowledge overlaps with Wenger’s when the latter writes, “Our knowing – even of the most unexceptional kind – is always too big, too rich, too ancient, and too connected for us to be the source of it individually” (1998, p. 141 [see below, section 2.6]). Therefore, when users use technologies in innovative, disruptive ways it may be helpful to understand users’ prior experiences and their position in relation to the dominant culture. Disruptive use of technologies occurs, but some disruption is more welcome than others. Fry

and Love (2011), for example, report lecturers using VLEs, but resisting VLEs' disruptive potential by limiting their use to a content repository.

Conole *et al.* (2008) add empirical weight to Smagorinsky's position by looking at how VLEs and other technologies are used in practice. Their survey of 427 students suggests students create their own networks to support learning (p. 517), but that pedagogical practices are not changing radically as a result of the advent of digital technologies. Technologies fulfil requirements, but without providing a distinctive pedagogy for learning and teaching, despite the design potential to do so. If students are managing their learning needs through technologies outside the HEI, it poses the question of whether HEIs should supply traditional VLEs. However, Conole *et al.*'s research showed students with substantial professional or personal commitments valued the VLE (p. 518). VLEs may be peripheral to some students' learning, but this is not a problem, because the periphery provides valuable learning, as argued by Lave and Wenger (1991), and, moreover, there is a group of learners to whom VLEs are important.

Conole *et al.* highlight a problem, namely "a mismatch between our current offerings and student use and a further mismatch between institutions' perceptions of student use of technology and actual use" (2008, p. 519). A top-down approach to technology enhanced learning in HEIs is leading to

misplaced investment and under-utilised VLEs. Conversely, this research is rooted in academic community members' practice, and its implications.

When examining the effects of technologies (specifically, a VLE) on academics' teaching practices, Blin and Munro (2008) critique the impact of technology on learning and teaching in higher education, suggesting technology has not changed pedagogy. They report that in their own institution in 2004, traditional lectures and tutorials were the dominant teaching paradigm (p. 482). However, a Moodle VLE was introduced, comprising an opportunity to rethink learning and teaching. The move was successful in the sense that, by the end of the 2005-06 academic year, 70% of academic staff were using the VLE. However, an examination of the objects uploaded to the system showed traditional learning materials (such as Word, pdf and Powerpoint files) dominated (p. 484). Therefore, the disruptive potential of the learning technology was not realised. However, it is also possible that VLEs are, by their nature, sustaining technologies, offering enhanced convenience of access, but not prompting a fundamental rethink of learning and teaching. A similar conclusion was drawn by Fry and Love (2011); their interviewees use a range of metaphors for VLEs ("security blanket," "crutch," "electronic filing cabinet" [p.54]). Interviews for this research (see subsequent chapters) identified instances of potentially disruptive (in Christensen's sense) practice with VLEs, but Blin and Munro (2008), and Fry and Love (2011), identified continuities between face to

face and online learning, leaving unrealised some aspects of the technology's potential.

Blin and Munro use Activity Theory as the primary lens for their analysis, but Disruptive Innovation is relevant too. Blin and Munro's research suggests it is challenging to create a disruptive technology in higher education, as the disruption emerges through practice and is not an intrinsic feature of the technology itself. What can be attempted, however, is a creation of the conditions in which disruption can happen. This involves a receptive and accommodating approach to the use of technologies for learning, even when those technologies are not explicitly technologies for learning. It may further involve the kind of conscious market manipulation suggested by Markides (2006), with learners and teachers being made aware of the learning and teaching possibilities of technologies within a higher education context.

Timmis (2012) argues that students have a wealth of digital technologies available to them, but it is unclear whether this is an asset or a burden: "Undergraduates have to manage a plethora of different digital communication tools and spaces. These include university owned spaces such as virtual learning environments..., university email systems and their own personal communications and social media... This implies continual multitasking across formal and informal settings and boundaries" (p.4). An alternative to multitasking is demarcation, and it is possible that students are

using specific technology tools for specific purposes. Rienties *et al.* (2013) argue, “students are now familiar with the format of communication through social learning tools (e.g., Facebook, Twitter) and expect these to be replicated in the classroom” (2013, p.122), but this thesis argues that demarcation is a more common practice, with academic community members not using social networking technologies, for example, to support learning and teaching, as suggested by the final survey for this study (see chapter 6).

A number of interviewees for Timmis’s research employed a demarcation between technologies for study, and technologies for social life: “students wanted to maintain the boundaries between their personal and study-related communications” (pp. 9-10). Her research challenges the idea that students use a wide range of technologies to support their learning. Consequently, the conception of students as fervent multitaskers (Prensky, 2001) is flawed, or at least debatable; a plethora of technologies is available, but students may well value ease of use and convenience (Christensen 1997, p. xv) above plenitude.

A further possible approach to disruptive technologies is to suppress their disruptive features. Sharples’s (2002) main focus is on school learning, but his discussion of technologies in education has wider relevance. Having surveyed technologies and their prevalence, he states, “the response of

educational institutions to such powerful technologies has, almost universally, been to treat them as a threat to be countered” (p. 2). Part of the reason for this is structural: “Institutional learning depends on the classroom being a sealed environment, with all outside interventions being carefully regulated by the teacher” (p. 3). Sharples realises the implications of allowing the net into the classroom: “we can welcome students who bring their own personal communicators and computers, but in the full knowledge that they will disrupt traditional learning and that this disruption needs to be managed” (p. 7). His research focuses on a prototype device used to support schoolchildren’s learning, and in this sense his approach is, paradoxically, more akin to the sustaining technology approach (Christensen, 1997): “another possibility is for future mobile devices to be designed so that they provide just the tools that are required or allowed in different contexts” (Sharples, 2002, p. 14). There is still a desire, in Sharples’s argument, to contort technology to serve the existing pedagogical model, rather than using the technology to construct a distinct pedagogy. Sharples correctly identifies the challenge to existing learning and teaching caused by technology, but does not follow through fully with the implications of the tension which, in Engeström’s analysis, create the conditions for new knowledge and activity systems to be constructed (Engeström, 2001, p. 137). Other commentators have identified barriers to disruption, such as Yu and Hang (2009), who argue that structural features of organisations can militate against disruption, by encouraging middle managers to defend their existing territory and practices, rather than innovate. Therefore, disruptive

innovation can be suppressed in the face of established, if not entrenched, practices.

While disruptive technology is a distinctive and innovative approach to understanding technology adoption, it is not without precedent. The Technology Adoption Model (Davis, 1989) argues that perceived usefulness (the ability of a technology to get a job done) and perceived ease of use (“the degree to which a person believes that using a particular system would be free of effort” [p.320]) shape the adoption of technologies. The model is simple and therefore lucid, but it is also arguably reductive. Bagozzi (2007) identifies the “parsimony” of the Technology Acceptance Model as both a strength and a weakness; a strength because it posits a causal and linear relationship between perceived usefulness and perceived ease of use on the one hand, and intentions to use on the other; a weakness because of its reductiveness (p.244). While acknowledging the applicability of the Technology Acceptance Model as a general guide to understanding technology adoption in education, the disruptive technology approach is a more useful and more illuminating lens for this specific research because it cites four factors rather than two, thereby largely avoiding the issue of reductiveness, and, more importantly, because its primary focus is on both the product, i.e., the technology, and practice with the product. Disruptive technology hones in on the tool being used more than it focuses on the human subject undertaking the usage. This stress is relevant because Activity Theory, which is also used in this thesis, argues against the idea of

the human subject as unique and inviolable (thereby implicitly challenging psychological interpretations of technology adoption because it questions the idea of stable and immutable selfhood), and argues instead that the human subject, in terms of its consciousness, is a product of historical and social forces (see below, section 2.4). It is a core tenet of this research that practice is social as, indeed, as identity. Innovation, therefore, does not occur in a vacuum but in contexts which both open up and circumscribe parameters of innovation. This is not to denigrate other approaches *per se*, but to serve coherence; the theoretical approaches used in this thesis view identity, practice and innovation as ultimately social phenomena. It is therefore internally coherent for this research to adopt the disruptive technology approach, because it directs the analysis more towards the technology tool than towards the subject undertaking the usage, though this research is also fundamentally interested in the interactions, the intertraffic, between subjects and technologies (but not in the subject in isolation, nor in the subject as a primary or all-determining explanation for technology adoption).

In addition, disruptive technology was further developed by Christensen and Raynor (2003) into a more nuanced position, arguing that practice determines usage and thus catalyses innovation. Notwithstanding the input of designers, technology usage is not determined *a priori* by design but by usage in practice, which is a more complex approach than the Technology Acceptance Model. Davis (1989) argues, “the prominence of usefulness

over ease of use has important implications for designers” (p.334), but disruptive innovation argues that practice takes priority over design in determining usage and purpose: to deploy an analogy, practice is the base and design the superstructure. Hu, Clark and Ma (2003), in a study of 130 school teachers, argued teachers were unlikely to accept a technology simply because it was easy to use (pp.236-237), though Sumak, Hericko and Pusnik (2011) argued that it was more likely that “professors/teachers” would use a technology for teaching purposes if it was easy to use (p.2073). This research uses the four criteria set down by Christensen (1997) and the more developed understanding of disruptive innovation put forward by Christensen and Raynor (2003) to analyse the adoption of technologies, seeing use as primary in determining purpose. Moreover, Bagozzi argues, “more is needed in TAM [Technology Acceptance Model] explicitly focusing on end-state goals/objectives of technology use” (2207, p.245). This research is able to focus on the objectives of technology use through the blending of the disruptive technology approach with Activity Theory, which has the objects (purposes) to which technology use is directed as one of its core concerns. Therefore, through its focus on objects (in the sense of purposes), Activity Theory enables a particular form of analysis which is less present within the Technology Acceptance Model.

2.3.1 Summary of key points from disruptive technology

Christensen's work is relevant to this research because it enables the identification of disruptive technologies and shows how disruption emerges through practice. Furthermore, Christensen's work identifies the typical criteria of disruptive technologies (cheaper, simpler, smaller, more convenient [1997, p.xv]). Consequently, this research will examine technologies conforming to Christensen's criteria.

The Disruptive Innovation framework (Christensen and Raynor, 2003), expressed through the use of disruptive technologies, is also a valuable approach for this research because Disruptive Innovation places emphasis on practice rather than design, and is thus rooted in individual's actual practices with technologies to support learning and teaching in higher education. This research is similarly focused on practice and on the implications of practice.

Disruptive Innovation also suggests technologies take hold not by confronting existing technologies, but by building their own networks of users (Christensen *et al.*, 2008). This research will therefore be focused on how and why academic community members use potentially disruptive technologies in preference to institutional resources, yet their use also

appears to be concentrated on a small range of technologies, sometimes acting as hub technologies (e.g., Google) from which other resources are accessed. By looking at specific, disruptive technologies, this thesis will enable an understanding of how HEIs can engage with disruptive technologies.

2.4 Activity Theory

Having used Christensen's work to identify the kind of technologies that will feature in this thesis, this sub-section outlines the framework that will be applied in order to better understand the impact of disruptive technologies on higher education learning and teaching.

Activity Theory (Leontiev, 1978, 1981) is a framework for analysing purposeful human activity. Activity Theory argues that human actions are mediated through the use of tools. Furthermore, Activity Theory is focused on understanding the means by which human activities develop and redevelop in social contexts (Kaptelinin and Nardi, 2006). Therefore, Activity Theory "postulates that an activity has to be analyzed both as an individual process and a social process" (Taurisson and Tchounikine, 2004, p. 84). Bennett (2010) argues that Activity Theory is a useful analytical lens because, "it moves the focus of analysis from the technological tool to the way that tool is used by people to achieve a purpose" (p. 10), thus eschewing technological determinism. Consequently, the prime unit of

analysis when investigating human activity *via* Activity Theory is human activity itself.

Vygotsky conceptualised the original model of human activity as a triangle.

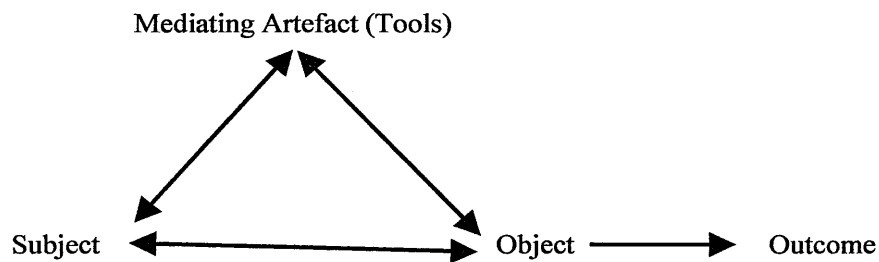


Figure 2.1 First-generation activity system, after Vygotsky (1978)

Vygotsky's model shows how human beings do not interact directly with their environment. Instead, they use physical tools and abstract resources as mediators, in the pursuit of objects (purposes). However, outcomes can be distinct from purposes, leading to the amendment to the triangle.

Vygotsky (1930/1998) challenged the dualism between the individual and the social. Instead of seeing the individual as unique and inviolable, Vygotsky claimed that identity is constructed ultimately by economic forces of production and resultant social relations (p.176). If Vygotsky is correct, then consciousness, thoughts, and the articulation of thoughts through practice are determined by the material and historical conditions within which any individual resides: "We have to proceed from the basic assumption that intellectual production is determined by the form of material production" (p.177). Vygotsky's position in this regard may imply

a link from Vygotsky to Smagorinsky (2001) and Markides (2006), with the potential uses of a technology, building on Vygotsky's argument, being determined by economic and social forces. Moreover, Vygotsky's core argument that consciousness, subjectivity, is shaped by historical and social forces continues to feature in Activity Theory based studies (e.g., Roth, 2007), and is also partly echoed in the Community of Practice framework, which argues that identity is a "work in progress, shaped by efforts – both individual and collective – to create a coherence through time" (Wenger, 1998, p.45).

Vygotsky also believed in the transformative potential of education: "It is education which should play the central role in the transformation of man – this road of conscious formation of new generations, the basic form to alter the historical human type" (1930, p.181). Through education, individuals and groups can question their existing practices, perceive the forces underlying their practices and postulate new practices. Actions create consciousness, and thus contain the potential to change consciousness. Education can thus create the possibility of a challenge to an existing activity system, as education enables the critical interrogation of existing economic and social relations. Therefore, this research discusses the extent to which technology use might be challenging existing activity systems in higher education.

Vygotsky also argued that functions of consciousness, such as imagination, emerge and develop not from an inviolable essence of self, but "in

connection with the development of the form of socially defined activity that we call play” (p.123). Therefore, consciousness changes through practice, and is not fixed. Individual psychology develops in conjunction with social systems. Having readily available technologies creates opportunities for play, which are necessary, in Vygotsky’s argument, to develop functions of consciousness such as imagination.

Other writers, such as Huizinga (1938/1971) have seen play as a fundamental aspect of human practice and an instinctual feature of humankind, and Rodriguez (2006) applied the principle of play to technology enhanced learning, but Vygotsky is distinctive in seeing functions of consciousness as a product of play. Huizinga suggests that play is instinctive in human beings, while Rodriguez argues for play as a mode of learning, and indeed as a self-fulfilling purpose of learning; playful, exploratory learning, consequently, is not about the enhancement of learning and teaching, but about “a profound rethinking of its [teaching’s] methods and subject matter.” What this means for technology enhanced learning is that learners can be given the technology and simply see where it takes them. If the outcome is not utilitarian then the learning has not failed, because, Rodriguez claims, playing with technologies can be intrinsically fulfilling for the learner. Litowitz (1997) similarly sees learning as instinctive, though focused more on the instinct to pursue an identity than instinct to pursue mastery of content (p.475). The idea of learning comprising self-direction (something we do, but not because we are told to do it) is placed in a more orthodox educational context by Krejsler (2004, p.

501): “May we to a larger extent orchestrate the classroom as some sort of agora... By understanding spaces of learning like that, we would implicitly encourage the student to experiment in ways whereby he/she may eventually acquire for himself/herself more mature autonomy.” Vygotsky’s distinctive argument is that play is constructive in a literal, non-value judgement sense, as it constructs functions of consciousness, such as imagination. In Activity Theory terms, the interaction of subject, tool and object can shape the subject (the individual user) and thus this research focuses on how technology usage impacts on individual human subjects in learning and teaching contexts, as well as arguing that individual subjects’ interactions with technology tools, whether the interactions are utilitarian or recreational, are what create purposes for technologies.

Following Vygotsky’s death, his work was taken up by Leontiev, whose example of the primeval collective hunt, in which the group acts as a team, with demarcated roles, for its collective benefit, has become an exemplar of Activity Theory, as a community uses its collective resources to achieve an object (1981). Leontiev states that “activity is a process of intertraffic between... subject and object” (1978, p.3), and therefore the object can affect the subject, as well as *vice versa*. He further follows Vygotsky in seeing social relations as preceding consciousness: “internal processes of thought are produced from the external” (p.5). In addition, he shows how the division of labour arises from the object (purpose) of an activity: “The activity of people working together is stimulated by its product, which at first directly corresponds to the needs of all participants. But the simplest

technical division of labour that arises in this process necessarily leads to the emergence of intermediate, partial results, which are achieved by individual participation in the collective labour activity, but which in themselves cannot satisfy the need of each participant” (pp.6-7). He develops the example of the hunt:

Let us assume that a person’s activity is stimulated by food, this is his motive. However, in order to satisfy the need for food he must perform actions that are not directly aimed at obtaining food. For example, one of his goals may be the making of trapping gear. Whether he himself will later use the gear he makes or pass it on to other participants in the hunt and receive part of the catch or kill, in either case his motive and goal do not directly coincide (p.7).

Leontiev argues, “the existence of individual mentality, a psyche, in the form of consciousness is impossible” (1978, p. 12). Consequently, alternative understandings of technology adoption, such as those based on teachers’ beliefs and attitudes (e.g., Norton *et al.* 2005) are problematic within this research because they are predicated on a stable self and a relatively uncomplicated understanding of selfhood. Norton *et al.* (2005) argue, based on a questionnaire with 638 responses, that there is very little evidence that teachers’ conception of learning change (p.556), but the argument tends to presuppose that identity is stable, whereas Activity Theory sees identity, in the sense of consciousness, as a product of historical and social forces and in a state of flux because of the intertraffic (as Leontiev phrases it) between subject and object. If consciousness is a product of historical and social forces, rather than a pre-existing condition,

in the sense of an inviolable essence of self, this has implications for the disruptive use of technologies, which is thus limited to the epistemological parameters of any given era (Foucault, 1970). Creativity, in the narrow sense of creating something new to meet a need, is a product of intertraffic. The act of creation implies an absence in an existing activity system and in this sense creativity is dialectic, fuelled by a contradiction within an existing activity system. Theoretical approaches based on the inviolability of individual identity will see innovation as the product of the creative individual, but the approaches adopted in this thesis view identity as social, with innovation and creativity as dialectic, prompted by historical conditions while at the same time posing a challenge to the extant conditions. Gay, Rieger and Bennington (2001) summarise the position by defining Activity Theory as “draw[ing] attention to the dialectical process by which consciousness, learning, and development simultaneously shape and are shaped by technology” (p.509). Consciousness, identity, is not fixed and is therefore, within the terms of this thesis, an unstable place from which to commence an investigation of the use of technologies. Instead, this thesis is rooted in an examination of technologies and of practice with technologies.

If consciousness is socially constituted, as Vygotsky (1930/1998) and Leontiev (1977) argued, individual psychological problems are manifestations of underlying conflicts in social relations. Extending the argument, uses of technologies are social rather than individual and the disruptive use of a technology is the result of a social pressure which may

express itself through an individual's practice, but without the disruption being the product of a sole, individual consciousness. Disruptive innovation is, Activity Theory suggests, social. Hence, understandings of technology adoption that focus on the individual learner and teacher do not sit easily alongside this position. It may be possible to design interventions (for example, training programmes for teachers) to change individual teacher beliefs over time, but that teacher will still be operating in social contexts. If we take the teacher, in second generation Activity Theory terms, as subject, an altered teacher belief as object and a designed intervention as the tool, we still need (within the second generation activity system, see section 2.5 below) to factor in the social dimensions of rules, community and division of labour. The rules of the system within which the individual teacher operates may determine the technologies used and how they are used, the community of learners and teachers in which the teacher is implicated may have its own norms of technology usage, and the division of labour may also determine what technologies the teacher uses and how they use them. Therefore, the designed intervention by itself is not all-determining. Beliefs may shift, but, this thesis argues, not mono-causally; Rienties *et al.* (2013), in a study of an online teacher training programme for technology skills, featuring 73 participants from 8 HEIs, found that the participants' skills increased substantially, but acknowledged that the change might have happened without the programme (2013, p.129). Bagozzi (2007) accepts a weakness in the Technology Acceptance Model, writing, "technology acceptance research has not considered group, cultural or social aspects of decision making and usage very much" (p.247). The adoption of

technologies is, this research argues (in line with Disruptive Innovation, Activity Theory and the Community of Practice theory), primarily social and shaped historically.

Activity Theory argues that tensions between nodes in an activity system are historically accumulated. Furthermore, while tensions are problematic they also contain the potential for progress. Linking this core position to the development of Activity Theory as presented by Axel (1997), individual problems signify social problems, requiring social rather than individual solutions. Applying the idea to this thesis, the disruptive use of technologies can comprise an early warning system, signifying the growing inapplicability of existing practices in learning and teaching.

2.4.1 Summary of key points from Activity Theory

Activity Theory argues subjects' actions are mediated through tools to attain objects. This research traces a similar argument, examining how academic community members use tools to get jobs done. From a Technology Acceptance Model perspective, Hu, Clark and Ma (2003) make a similar argument when they write, "our analysis suggests a task-centred orientation in teachers' technology evaluation and a pragmatic anchor in their acceptance" (p.236). The metaphor is interesting because it implies a point

of fixity based on use value. The anchor is, in Activity Theory terms, the object, for which purpose tools are applied pragmatically. Furthermore, Activity Theory implies that there are limits to what can be attained through the interaction of subjects and tools, limits shaped by prevailing economic, historical and social conditions. This research takes a similar line, by arguing that there are parameters to disruptive innovation. These parameters are primarily historical and social. They are not, primarily, economic because this research focuses on technologies conforming to Christensen's four core criteria, including cheap (1997, p.xv). This is not to argue that economic factors do not apply to technology adoption, but the issue is largely outside the scope of this research. Hargittai (2002, 2010) qualifying the work of Prensky (2001), argues there is a digital divide but that it is constructed socio-economically. This research did not probe the socio-economic status of its participants, and is interested in technologies that are free to anyone with access to a networked device.

In addition, Activity Theory implies that tensions within an activity system can signify or illuminate a wider social problem. This research is similarly focused on tensions within an activity system, and what this signifies or illuminates. This research uses second generation activity theory (see 2.5 below), to use an Activity Theory term, as a tool, to aid the examination of specific and focused areas, especially the impact of disruptive technologies on the social nodes in an activity system, and, perhaps most especially, the possible impact of disruptive technologies on the division of labour in UK higher education, and the role of HEI as gatekeeper to knowledge.

Having examined Activity Theory, the next section therefore discusses the development of Activity Theory into second generation Activity Theory based on the theory of expansive learning.

2.5 Second generation Activity Theory based on the theory of expansive learning

The thesis also uses the second generation Activity Theory based on the theory of expansive learning. The approach is relevant to this thesis because it enables an exploration of how the use of disruptive technologies is collaborative, impacting on a community, its rules, and its division of labour.

Engeström (1987) developed an expanded model of human activity (commonly known as the activity system) to include and highlight the collaborative nature of human activity, adding social elements to Vygotsky's original model of human activity. This representation is also known as the second generation activity system and is shown below.

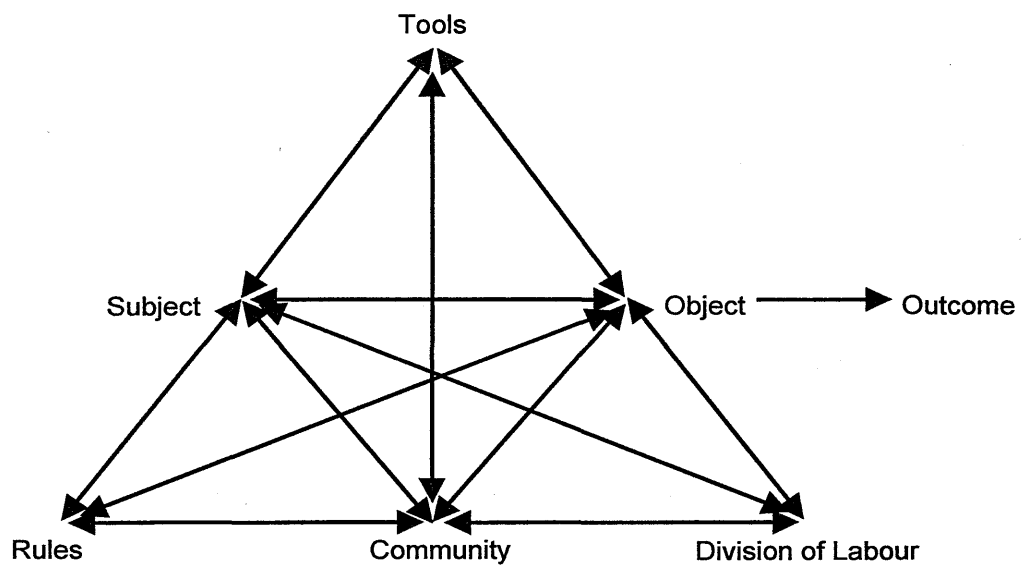


Figure 2.2: The second generation activity system (Engeström, 1987)

The bottom row of the triangle (the layer added by Engeström) features the rules, the community and the division of labour as its nodes. The rules node represents the conventions and regulations shaping an activity (such as assessment within an education system). Community refers to those affected by the activity (the academic community in the context of this research), and the division of labour node represents who does what in an activity, thereby illustrating both the distribution of tasks and the hierarchy of power.

Engeström (1987) claims that learning *per se* is unintentional and inevitable, and identifies a mismatch between formal and real world learning, a position also taken by Lave (1996). Formal education is a particular type of learning, but does not have a monopoly on learning, a position later echoed

by Wenger (1998, p.267) who argued learning is inevitable and ongoing, with teaching comprising one structuring resource for learning. If learning is something humans do, then it is appropriate to consider the kind of learning disruptive technologies facilitate, and how disruptive technologies are a particular manifestation of human learning practice.

Education systems have individuals who do not conform to the system. Engeström (1987) states: "The history of the school is also a history of inventing tricks for beating the system, and of protesting and breaking out. ... [T]oday's pupils are at an early age intensively drawn into the market as relatively independent consumers, even as producers... (as computer hackers, as sport stars and performers, etc.). When the pupils' direct participation in the societal production is intensified, the 'holding power' of the school is endangered. In this respect, school-going may well be approaching a crisis of new qualitative dimensions." Therefore, deviant behaviour, within an activity system framework, can signify the possibility of, or a need for, a new system for the production, distribution and exchange of knowledge, thereby linking Engeström's argument with Vygotsky's (1930/1998) earlier stress on the value of education. The idea of resistance highlighting a flaw in an existing activity system is also examined by Diamondstone (2002), who argues that the privilege of constructing meaning is the preserve of the powerful. Engeström later states: "The expansive cycle begins with individual subjects questioning the accepted practice, and it gradually expands into a collective movement or institution" (1999a, p.383). Therefore, instead of deviant behaviour being a sign of

disorder to be quelled, Engeström's argument implies that nominally disruptive behaviour expresses the inadequacies of an existing system, requiring structural re-evaluation rather than castigation of an individual (2001, p. 137). Disruption, therefore, can be the expression of inadequacy in an existing system, and a call for change.

A further feature of Engeström's (1987) thinking is that activity is not only primary, but also collaborative. Activities can be undertaken by individuals, but the individual is always implicated in a range of historical and social discourses: "Human labor, the mother form of all human activity, is co-operative from the very beginning," a position echoing Leontiev (1981) and his image of the primeval hunt. Furthermore, and in this specific sense, Engeström's position overlaps with the Technology Acceptance Model. Bagozzi (2007) argues, "we sometimes act seemingly as individuals spontaneously, deliberately, or in response to social pressure. But perhaps more often than not we act interpersonally, or as agents of organizations, or jointly with others, or in a holistic sense as members of collectives. Decisions with regard to technology acceptance and actual usage are often done collaboratively or with an aim to how they fit in with, or affect, other people or group requisites" (p.247). Therefore, activity can be individual but is at the same time necessarily social, because, within the theoretical positions adopted in this research, individual consciousness is determined by its historical and social context. Bagozzi's (2007) use of the adverb "seemingly" acknowledges that individual activity is more complex than it might at first appear. Activity is, this thesis argues, socially contextualised.

Engeström emphasises that contradictions are the catalyst for change. Solutions to contradictions take place in the form of “invisible breakthroughs.” In terms of how breakthroughs, or innovations, happen, “In reality it always happens that a phenomenon which later becomes universal originally emerges as an individual, particular, specific phenomenon, as an exception from the rule. It cannot actually emerge in any other way.” The innovation appears irregular at first, but becomes, over time, mainstream, as its suitability and usefulness to its context is recognised. Engeström later amplifies this point when he writes, “The expansive cycle begins with individual subjects questioning the accepted practice, and it gradually expands into a collective movement or institution” (1999a, p.383). In this sense, Engeström’s argument aligns with Christensen’s analysis of disruptive technologies (1997), which disrupt an existing commercial or educational system and seem unorthodox at first, but become accepted, and indeed displace, an existing product or service.

Daniels (2008), following Engeström (1999b), outlines Activity Theory with the help of five principles. The first is the activity system, seen in network relations to other activity systems. The second is multi-voicedness; activity systems embody different perspectives and interests. The third principle is historicity; activity systems evolve and transform over time. The fourth principle is that contradictions (what Engeström [2001, p. 137] defines as “historically accumulating structural tensions”) are central as sources of change and development. The final principle is the possibility of

expansive transformation in activity systems. This thesis hones in on individual activity systems, but recognises different perspectives within activity systems as the thesis includes different roles within academic communities. The second generation approach allows a focus on tools within an individual activity system and therefore a focus on how tools develop individual activity systems. The research also recognises development in activity systems, partly through recognising the centrality of practice in the creation of purposes for the use of technologies. The research also focuses on recognising and exploring contradictions, and recognises possibilities for transformation through the use of technology tools.

A key aspect of Vygotsky's and Engeström's understanding of the interaction between human subjects and tools is that tools are not the passive recipients of human action. Instead, tools are "integral and inseparable components of human functioning" (Engeström, 1999b, p.29). Technologies are essentially inert until they are drawn into human actions (a position also taken by Grint and Woolgar, 1997) but, once drawn into actions, tools shape as well as are shaped (Engeström, 2007), not least because the tools carry with them traces of previous human action and innovation, in the sense that they will have been designed to undertake particular jobs in particular historical, economic and social contexts. This is relevant to this research because it asserts that engagement with disruptive technologies is a two way process. The technologies deployed to undertake certain jobs in support of learning and teaching have an impact upon subjects, objects and the social relations inhering in purposeful human

activity (social relations as defined in the second generation activity system).

The kind of learning activity that exposes contradictions in an activity system and leads to the construction of a new one is, in Engeström's terms, expansive learning. Engeström introduced the theory of expansive learning (a) to portray the collaborative nature of human activity which is not explicitly represented in Vygotsky's original model, and (b) to develop a theory that was specifically focused on adult learning. The distinctive feature of expansive learning is that it starts with an act of potential dissent, with the critical interrogation of an accepted and established practice (1999a, p.383). In this sense expansive learning is disruptive, thereby linking Engeström with Christensen. Disruptive technologies are culturally anomalous at first, such as the Honda motorcycle in an American motorcycle culture shaped by Harley Davidson machines (Christensen, 1997), or the technically inferior reception of a Sony transistor radio (Christensen *et al.*, 2008) but assert their own applicability by changing, however locally, a culture. In each of these two examples provided by Christensen, the practice of users created a purpose and disrupted an established market in so doing.

The contradictions and tensions in the interaction of the nodes in an activity system are significant in expansive learning, as the contradiction can enable the construction of new knowledge. For example, a lecturer (subject) works

with students to achieve the object of high-quality learning. Technology (tools) can be used to enable the learning. However, if a new tool is available, over which the students, rather than the lecturer, have mastery, there are implications for the nodes on the bottom row; new practices within the activity system, such as a different division of labour, may be required in order for the object to be accomplished, as Scanlon and Issroff (2005) observed in their research. Engeström (2001) argues, “When an activity system adopts a new element from the outside ..., it often leads to an aggravated secondary contradiction where some old element (for example, the rules or the division of labor) collides with the new one. Such contradictions generate disturbances and conflicts, but also innovative attempts to change the activity” (p. 137). The analysis overlaps with Christensen’s theory, in the sense that a new technology can disrupt existing practices, thereby risking rejection, but also that the new technology can go on to change the practice itself.

Within the context of this research, interactions between subjects and tools are examined to observe the extent to which wider changes may be taking place, but it is important to note that uses to which technology tools are put is a matter of practice, not design. As Engeström states: “the material form and shape of the artifact have only limited power to determine its epistemic use” (2007, pp. 34-35). This leads Engeström to conclude, “In Expansive Learning... reconfiguration of given technologies by their users is essential” (p. 35). Subjects explore the meanings of technologies through their uses of them and meaning is not constrained by design, an argument also presented

by Christensen and Raynor (2003) though, according to Activity Theory, use and therefore meaning are shaped by history. Moreover, and in common with Wenger (1998, pp. 227, 233), Engeström argues that learning requires imagination, improvisation and innovation.

Expansive learning is not a trouble free process; Russell and Schneiderheinze (2005) note the difficulty of incorporating new technologies into existing pedagogies:

When technologies are inserted into the educational environment, they are meant to develop learning abilities in the students. However, these technologies do not function in the vacuum... When teachers attempt to implement a technology innovation in the classroom, they naturally face the complex challenge of fitting together new ideas with deep-rooted pedagogical beliefs and practices. (2005, p. 39)

This may be one of the reasons why technologies have not necessarily disrupted teaching practices in higher education (Blin and Munro, 2008; Margaryan *et al.*, 2011), because of the pressure to conform to the existing model exerted by the other nodes in the activity system.

Scanlon and Issroff (2005) provide an example of how technology can alter relationships within higher education:

In one particular instance, several students attempted to help the lecturer to fix the technology so that he could

continue his lecture with the complex medical images he had prepared on his laptop. This is a change in the normal rules of the lecture method in that usually students are passive recipients who sit in the audience while the lecturer stands up on stage presenting information. When the technology failed, some students broke the normal rules and tried to help the lecturer. This also represents a change in the division of labour in the learning setting (2005, p. 435).

Relying on technology in a classroom setting relies, in turn, on competence with technology which, unlike subject competence, is not the preserve of the lecturer. Therefore, relationships get reconfigured in order to better the learning experience for everyone. Conversely, Fry and Love (2011) cite lecturers not putting some of their learning materials online, thereby retaining their position of authority in the division of labour, but not necessarily enhancing learning for students.

Engeström and Sannino (2010) offer a structured account of how expansive learning happens (2010, p. 7). The first act is questioning. The second action is analysis, trying to examine causes of the present situation. The third stage is to construct a model of a new idea. Stage four is analysis of the new model, and stage five its implementation. Thereafter, the implementation of the new idea is reflected upon and evaluated (stage six), leading to its consolidation (stage seven). Questioning established practice is not always welcome in educational settings, and it generates a potential contradiction within an activity system, but, for Engeström and Sannino, questioning is a necessary stage for enabling the construction of new knowledge (p.5).

A further, central characteristic of expansive learning is that it requires human agency: “Changes must be initiated and nurtured by real, identifiable people, individual persons and groups” (Engeström and Sannino 2010, p.6). Therefore, while a contradiction, disruption, critique or manifestation of dissent is the starting point for expansive learning, the learning does not happen organically: “Contradictions are the necessary but not sufficient engine of Expansive Learning in an activity system” (p.7). Consequently, although contradictions evolve historically (p.4) they do not play out as a matter of historical necessity and, instead, require intervention to bring the expansive learning to fruition.

However, change does not axiomatically imply progress: “Expansion necessarily involves also the possibility of disintegration and regression” (Engeström and Sannino, 2010, p.11). Consequently, change needs to be managed, and this may be what Avis (2009) refers to when he argues that Activity Theory and expansive learning eschews the revolutionary implications of its own analysis, becoming instead a management technique (2009, p.161). In addition, Engeström’s and Sannino’s argument indicates that a technology can alter an object without necessarily enhancing it, an argument echoed by Benson and Whitworth (2007), who suggest Activity Theory can be used diagnostically, without necessitating change. Therefore, an evaluation of the effectiveness of a technology involves considering how it impacts on other nodes in an activity system, as well as the extent of its conformity to Christensen’s (1997, p.xv) formulation. Social networking

technologies, for example, have the potential to affect learning and teaching, but this may not be what users want (which is what this thesis, in part, argues), as users wish to keep their learning and teaching community separate from their recreational community, a position also noted in the sample of 213 students in Madge *et al.* (2009), though contradicted by some of the studies summarised in Manca and Ranieri (2013).

According to Engeström and Sannino therefore, expansive learning is “a historical reality rather than an outcome of a designed policy. On the other hand, it does make sense to develop and pursue policies that can make expansive learning less painful and troublesome” (2010, p. 18). Expansive learning is ultimately a managed, though unpredictable process, a position which aligns with how this thesis understands Disruptive Innovation. The research argues that there are parameters to disruptive innovation, shaped by a range of factors. Disruption is not the unfettered expression of creativity. Similarly, expansive learning is not unbounded, but is managed, whether through direct human agency, or through broader historical factors.

Whitworth (2005) claims that “Conflict within organisations is inevitable, but without conflict there would be no creativity, and hence no innovation” (p. 690). However, Benson and Whitworth (2007) challenge an understanding of activity systems, namely that all contradictions therein need to be removed. Instead, they argue, “tensions within activity systems are not inherently divisive... ‘best practice’ may entail *understanding* the tensions within activity systems, rather than believing them to be

troublesome variables, better eradicated” (2007, p.79, emphasis in original). Other Activity Theory driven studies have revealed instances where contradictions were identified but not resolved (Barab *et al.*, 2002; Russell and Schneiderheinze, 2005; Basharina, 2007). Subsequently, Benson *et al.* (2008) draw attention to nodes within Engeström’s (1987) representation of the activity system, arguing that “Rules, roles and tools are as much the territory of centralised economic and political forces as they are for learning and teaching” (2008, p.466). Therefore, activity systems are not hermetic, as individual nodes within the activity system are shaped by wider economic, political and social factors. Moreover, Benson and Whitworth (2007) align with aspects of Avis’s (2009) view, but, whereas Avis critiques Activity Theory and expansive learning when it understands without altering, Benson and Whitworth see this as an asset, enabling full comprehension of a learning and teaching situation without insisting upon its radical overhaul.

2.5.1 Summary of key points from expansive learning

Expansive learning argues that contradictions within activity systems are necessary precursors to and catalysts of change. This thesis will, therefore, identify contradictions that exist in technology usage practices in higher education learning and teaching. The analysis of contradictions is also captured and framed in the use of the notion of disruptive technologies to identify technologies that are not specifically designed for educational

purposes but are used to support learning and teaching. Furthermore, second generation activity theory based on the theory of expansive learning argues for the multi-voicedness of activity systems implying that collaboration is key to the successful execution of any activity including learning and teaching in higher education. Therefore, this research evaluates the significance of social relations, the division of labour, and also rules and conditions that exist in the context in which disruptive technologies are used to support learning and teaching. An underlying aim is to understand the impact of these conditions and collaborative perspectives on learning and teaching. It is also argued that non-institutional sources comprise an additional voice, in the sense of an additional source of information (or, in Activity Theory terms, a tool), not owned or controlled by the HEI, but adding to existing voices. For example, reading lists for modules and programmes can be supplemented, or even supplanted, by resources located via non-institutional technologies. Furthermore, this research is centrally concerned with how HEIs in the UK can engage constructively with disruptive technologies, and an expansive learning approach enables consideration of how disruptive technologies are impacting on academic communities, thus assisting the construction of an argument concerning how the academic community can engage constructively with the technologies used in practice by its members.

Having looked at how the thesis will select technologies for examination, and how it will examine them, the next sub-section outlines a concept used to understand what is meant by an academic community.

2.6 Community of Practice

This sub-section outlines the Community of Practice theory. This sub-section also indicates how the Community of Practice is a suitable, albeit secondary, approach for this research to include.

The Community of Practice theory centres on identity formation in social contexts, within the structural context of centripetal progress from the periphery to the centre of learning communities (Lave and Wenger, 1991). In common with Activity Theory, therefore, identity is a construct rather than an essential quality. The Community of Practice is used in this research to more fully comprehend the academic community (community being a node in an activity system) and to explore a sense of how learning with new technologies may happen in practice. The HEI community comprises, for the purposes of this research, students and lecturers, but also staff in academic related roles entailing regular contact with students and lecturers. The use of the Community of Practice in this research aligns with Engeström's second generation activity system, in the sense that the activity system identifies the community as a node, and the Community of Practice theory frames the nature and composition of the community, within a higher education context in this instance.

The term Community of Practice derives originally from work by Lave and Wenger (1991), who argued that learners start on the periphery of

communities and travel towards the community's centre. Good progress relies on a supportive structure within the community. Wenger (1998) subsequently developed the Community of Practice, arguing for a close link between learning and identity: "Education... concerns the opening of identities – exploring new ways of being that lie beyond our current state" (p. 263). Wenger also stated that learning is an unavoidable aspect of existence, is ongoing, and "may use teaching as one of its structuring resources" (p. 267). Recognising that learning is not contained in a classroom, we begin to recognise how technology can facilitate effective learning, irrespective of the learner's location.

Wenger argues that learning is controlled by the learning community, not by the external drivers that prompted the formation of the learning community (1998, p. 80), and adds, "Learning cannot be designed. Ultimately, it belongs to the realm of experience and practice" (p. 225). He later argues that learning is a matter of imagination (p. 227), and: "In a world that is not predictable, improvisation and innovation are more than desirable, they are essential" (p. 233). Therefore, learning for Wenger is a creative process, and an inevitable, ongoing fact of human experience. This aspect of Wenger's argument aligns with Christensen and Raynor's (2003) argument that disruption emerges through practice. Disruption is a form of learning in the sense that it is about constructing new possibilities. Therefore, for Christensen and Raynor, as for Wenger, learning belongs to the realm of experience and practice. Wenger's argument can also be linked to Engeström's expansive learning (1987), and Vygotsky's argument for play

as a form of learning (1930), because learning relies on creativity and improvisation, and using existing resources to create new uses for tools, and new purposes to learning.

A number of commentators have elaborated on or critiqued the Community of Practice. Fuller and Unwin (2004) claim the roles of novice and expert are not stable within the Community of Practice; novices can be more adept than experts at some tasks, for example those relying on technology, as was shown in the Activity Theory informed observation studies undertaken by Scanlon and Issroff (2005). Power relations, however, are a key factor. If the experts engage in dialogue with adept novices, then the community as a whole benefits, but the role of expert may have to be reconfigured. Alternatively, the experts can assert their power by excluding the expertise of novices; novices can use technologies to support learning, but experts can deem those technologies inadmissible within an HEI.

Jewson (2007a) explores the formation of identities within the Community of Practice framework. He acknowledges the importance of virtual environments, yet his argument takes a different focus: “A major shift is occurring in the physical spaces of work alongside the emergence of virtual work space” (p. 160). Drawing upon the work of Felstead *et al.* (2005), Jewson suggests that the panopticon is replaced by the polyopticon, where everyone is able to see everyone else in open plan offices (or rooms full of desktop computers in HEIs). Jewson argues that the underlying design vision is “intended to foster serendipitous cross-fertilization of thoughts and

perspectives” (p. 163). Networking becomes an unavoidable consequence of inhabiting the same place. Within this framework “performance of personality” becomes a key career asset (p. 164). The implications of Jewson’s argument are significant, because he suggests individuals have to have “a chameleon-like quality,... moving into and out of quite different ways of behaving” (p. 167). This is relevant to this research because people construct and support different identities (both learning and social identities) with different technologies; demarcation of technology use is an appropriate strategy linking to different identities (a similar conclusion was drawn by Timmis [2012]). Academic community members maintain different networks through different technologies. In addition, learners select different technology tools, as appropriate, for different tasks, as Conole *et al.* (2008) argued. Different practices are supported by different technologies in pursuit of different objects (this specific argument emerges in interviews undertaken for this research, and in the final survey).

Nickson *et al.* (2003) explore potential barriers to entry to a community, before the individual can be considered a peripheral participant. The authors’ focus is the service industry, and the idea that applicants have to hold particular persona attributes before they can be allowed entrance to the community. Wenger and Lave (1991) examine what happens within a community, but are less interested in what the individual has to do to gain entry. Applying the same principle to the higher education sector, bringing a new technology to a learning community can be a passport or an impediment to entry, depending primarily on the disposition of the

community gatekeepers. Similarly, Jewson (2007b) writes about individuals on the outskirts: “Those on the periphery of a network may have attenuated connections with the centres of decision making but nevertheless exercise great importance as the primary point of contact with outsiders and members of other networks” (p. 73). Jewson gives physical examples (receptionists, concierges) but the online world is relevant, too. A new entrant to an HEI can bring with them a technology they have used beforehand, thereby potentially linking their new community to other networks.

Unwin (2007) identifies a tension inherent in the Communities of Practice model: “the survival and reproduction of communities of practice depends on newcomers but, at the same time, their arrival threatens the role of old-timers” (p. 112). A similar point was made earlier by Lave and Wenger (1996, p.149), who stated, “there is a fundamental contradiction in the meaning to newcomers and old-timers of increasing participation by the former; for the centripetal development of full participants, and with it the successful production of a community of practice, also implies the *replacement* of old-timers” (emphasis in original). Therefore, Communities of Practice learning is not necessarily smoothly centripetal. Instead, tension is inscribed within it, an argument also made by Contu and Willmott (2003, p.287). As the entrant to the community forms their new identity, a perception of that identity as, ultimately, either threat or asset will be formed by the other community members. More positively, the constant replenishing of the HEI’s community of practice by new entrants creates the

conditions in which a range of constantly renewing technologies can be brought to learning and teaching.

More broadly, understanding what is meant by a community of practice, and understanding how the community of practice has been analysed by subsequent commentators, enables the community of practice concept to be condensed into essential components for this research, as summarised below.

2.6.1 Summary of key points from Community of Practice

The Community of Practice identifies a range of stakeholders contributing to learning and teaching generally, and, within the context of this research, in UK higher education communities specifically. This research interprets the academic community as a community of practice (notwithstanding tensions within communities of practice, HEIs have declared, overarching institutional goals and mission statements), and is further mindful that community comprises a node in an activity system.

The use of the Community of Practice further enables this research to consider how the use of technologies can enhance or impede an individual's progress within a learning community. It also enables consideration of how technology use can be affected by the technology practices of the specific community of practice as a whole.

Having surveyed the different theoretical approaches used to shape this research, a chapter conclusion is now offered, reiterating the key points.

2.7 Conclusion

This chapter has outlined literature around technology use in UK higher education and reviewed the three theoretical frameworks that underpin and inform the research carried out as part of this thesis. From this literature review, the thesis identifies the following key points drawn as summaries from the three theories discussed above to be further explored in research investigations –

- Disruptive technologies are “typically cheaper, simpler, smaller, and, frequently, more convenient to use” (Christensen, 1997, p.xv) than more established technologies.
- Disruptive Innovation (Christensen and Raynor, 2003) arises from practice rather than design.
- Disruptive Innovation can be shaped by structural or contextual changes (Moore, 2004) or effective marketing (Markides, 2006).
- Activity Theory comprises a means of analysing how technologies are used, and how they impact on learning and teaching situations.
- Expansive learning identifies potential contradictions in learning and teaching situations, and considers how they may be resolved.

- An HEI, in the context of this research, is understood as a community of practice, replete with the potential for internal tension yet with a range of roles contributing to institutional goals, some of which may be enabled by technologies.

The aim of the research is to consider how HEIs can engage constructively with disruptive technologies, to which end the following sub-research questions are addressed:

- What technologies are being used to support learning and teaching in Higher Education, and how are they being used?
- Are disruptive technologies being used to support learning and teaching in Higher Education in the UK?
- Are users utilising established technologies in disruptive ways?
- How is the disruptive use of technologies impacting on Higher Education in the UK?

The literature review complements the research questions by identifying specific, disruptive technologies used by academic community members and by providing a means to explore the significance of disruptive technology usage. The chapter has outlined each approach, and has also summarised how each approach has been commented on and critiqued subsequently. In addition, a hierarchy of theoretical frameworks used within the research has been established. Disruptive Innovation is used primarily to identify

relevant technologies, and expansive learning and the second generation activity system is used to evaluate the impact of disruptive technology use on learning and teaching. The Community of Practice is used to complement the main frameworks, identify the community under examination, and to outline how technology usage can enable progress within a community. This thesis therefore views learning and teaching as social practices, shaped historically. Consequently, psychological theories of technology adoption have limited applicability because this thesis sees identity as determined historically and socially. Teacher beliefs can change, but through the intertraffic of social forces. A designed intervention in relation to technology enhanced learning can be conducive to change and may catalyse change, but it does not make change happen in a mono-causal sense; when beliefs change within a higher education community of practice, this thesis argues that it is likely to be caused primarily by social factors such as changes to rules (e.g., assessment methods) or the division of labour (e.g., institutional expectations of technology use). Furthermore, in the case study by Blin and Munro (2008), a new institutional VLE was introduced, but pre-existing learning and teaching practices tended to persist and prevail, with existing teaching materials being uploaded to the VLE rather than new learning and teaching practices being produced. In addition, Activity Theory suggests that selfhood is not inviolable but is constantly reshaped historically and socially. This research is interested in that intertraffic and in what it implies for the use of institutional and non-institutional technologies to support learning and teaching in higher education in the UK; the usage of technologies (this thesis argues) produces

purposes for technologies, but the usage does not occur in an unfettered space but in contexts saturated historically and socially. Theories of technology adoption based on the economic availability of technologies to subjects are also of limited value in this research because, and in line with Christensen (1997), this thesis is interested in cheap (free, in practice) technologies and their impact. The next chapter will draw upon key points from the above theoretical approaches to inform the design of the research study and outline methods used to gather and analyse research data.

CHAPTER 3: STUDY DESIGN AND RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter reviewed literature relevant to the core research question of understanding how HEIs can engage constructively with disruptive technologies to support learning and teaching. Key theoretical concepts were identified, which will underpin research investigations in chapters four, five and six.

This chapter presents the rationale and logical flow of the study design and describes the methods used to gather and analyse research data. An outline of key research activities carried out, research methods used, study participants, study context and ethical considerations is given. The chapter also addresses methodological challenges and limitations encountered by the researcher during the study. Finally, selected information is summarised in a table presenting the research timeline in order to show how the research was planned and developed.

This principal aim, of considering how HEIs in the UK can engage constructively with disruptive technologies to support learning and teaching, is pursued by investigating the following sub-questions:

- What technologies are being used to support learning and teaching in UK Higher Education and how are they being used?

- Are disruptive technologies being used to support learning and teaching in Higher Education in the UK?
- How does the use of institutional technologies compare with the use of non-institutional technologies to support learning and teaching?
- How is the disruptive use of technologies impacting on learning and teaching in UK Higher Education?

In order to address the above research questions, a number of studies were carried out over a period of two years, comprising in total, 7 interviews, 7 observations and 115 survey responses. A detailed outline of the study design and research instruments used to support these investigations is presented as follows.

3.2 Study Design

The research reported in this thesis was organised into 7 phases, namely:

- Pilot study survey
- Semi-structured interviews (Phase I)
- Second survey (Phase II)
- Semi-structured interviews (Phase III)
- Observations (Phase IV)
- Structured interviews (Phase V)
- Final survey (Phase VI).

This approach was adopted in order to refine research instruments used more than once (principally, surveys), and to gain a range of data. A limitation of this approach emerged through the sample which, for all but the final phase, was focused on two HEIs (see below, 3.3). However, the different iterations of the research did reveal common features which, through the development of the research instruments, became increasingly apparent, such as the extent to which participants used a small range of technologies for a wide range of purposes, and participants' preference for non-institutional technologies over institutional technologies.

The individual research phases can be summarised as follows: the pilot study was undertaken in order to obtain a mixture of quantitative and qualitative data on awareness and usage of technologies, informed by the Horizon Report (Johnson *et al.*, 2010); the pilot study was focused on identifying the type of technologies being used by academic community members in UK HEI. Here, the study was trying to differentiate between (a) technologies that are formally introduced or established by HEIs (institutional technologies), and (b) technologies that are not formally introduced by HEIs for supporting teaching learning and teaching (non-institutional, disruptive technologies). The underlying aim was to establish whether the use of non-institutional technologies was disruptive to learning and teaching. The pilot study sought to address these questions through an online survey (online rather than hard copy because the sample was widely distributed, geographically). The survey comprised tick box, closed-ended

responses to some questions, including the use of a four point Likert scale (1932), a method which enabled differentiation of response (Cohen *et al.*, 2000, p. 253), and also featured longer, more open-ended responses to other questions, involving questions around the type of technology used, the context of use, usage patterns, and purpose. Analysis of the pilot study data revealed a need to investigate a wider range of technologies used by academic community members, so as to establish whether there were common practices in technology usage mechanisms across a range of technologies. This meant that Study Phase II (a second survey) was necessary to explore technologies that were being used, but were not included in the pilot study. The first two surveys were interspersed with semi-structured interviews (Phase I).

Phase I, the first phase of the main research, sought data about the use of both institutional and disruptive technologies; semi-structured interviews with a lecturer and a student looked at whether disruptive technologies were being used to support learning and teaching, and whether established technologies were being used in disruptive ways. While the open questions on the pilot study survey had prompted responses, it was felt that semi-structured interviews would enable longer, more considered and exploratory responses; Margaryan *et al.* (2011) also used interviews (of eight participants) to evaluate technology enhanced learning in the UK. Phase II produced further data from a survey, developed iteratively out of the pilot study, and Phase III consisted of re-interviews of the Phase I participants, to

examine how their use of technologies had developed since their first interviews, thereby investigating how technology use can change over time.

One of the issues produced by the research instruments is that they recorded what participants said they did with technologies, not what they did in practice. Therefore, observations were undertaken later on to record what participants actually did (Phase IV). The observations identified what technologies were being used, and how they were shaping individual learning and teaching situations. Observations were used previously in an Activity Theory driven study of technology use in higher education by Scanlon and Issroff (2005). Reflection on all the iterations from the pilot study to Phase IV identified issues meriting further exploration, which resulted in and shaped Phase V of the research.

Structured interviews (Phase V) revisited some of the themes uncovered by previous iterations of the research, for example the specific technologies that were or were not being used, and whether participants were using established technologies in disruptive ways, in order to clarify issues raised in previous iterations of the research. The participants comprised an undergraduate student, a postgraduate student and a lecturer. Reflection on all the research instruments used up to this point in the study resulted in the construction of a final survey (Phase VI).

The final survey (Phase VI), with a larger number of participants, investigated whether participants were using a range of technologies or

demarcating their technology use, deploying a small range of technologies to undertake a wide range of tasks. The survey also investigated whether participants were using institutional or non-institutional technologies. Moreover, the survey examined how technologies were being used by the participants to support their learning and teaching. The survey thus analysed the extent to which disruptive technologies were being used to support learning and teaching. A survey was used previously in a study of technology use in higher education in the UK by Conole *et al.* (2008), which examined the extent to which disruptive practices were evident in students' practices with technology enhanced learning.

3.3 Study Participants

The participants for this research came from various UK based HEIs. Two HEIs feature prominently in the sample. The first institution, which I will refer to as 'Organisation 1', specialises in distance learning, though some of the disciplines also have face-to-face provision. Written and informed consent was obtained from module leaders to ask students to participate; all but one module leader agreed (students from that module were, consequently, not approached to participate in the research). Participants were approached via group emails, and module online forum postings for recruitment purposes.

The second HEI to feature prominently in the overall sample is 'Organisation 2', which has a mixture of on-campus and distance learners. Organisation 2 runs degree programmes for undergraduates (typically, 18-21 years old), and also has a sizeable number of part-time students in full-time employment. The research sample as a whole is therefore diverse, but not fully representative of the wider UK HE sector as a whole. The approach is best described as non-probability convenience sampling (Bryman, 2004, p.100), an approach shaped by the researcher's access to different learning communities over the course of the research. The use of non-probability convenience sampling means it is not possible to generalise accurately, to extrapolate from the sample to make irrefutable claims about the UK higher education sector. That said, the final survey was made available more widely, to academic community members generally, in order to get a wider range of participants for the final survey. Therefore, the findings (qualified by other published works cited through the research) do highlight aspects of technology use by academic community members, relevant to the research's overall aim.

The Organisation 1 academic community members who participated in the research were studying or teaching modules in English and related subjects. The Organisation 2 academic community members who participated in the research were studying or teaching modules in banking, finance and related subjects. The subjects studied were therefore diverse, but, again, not representative fully of the wider HE sector, or the full UK higher education curriculum. However, it was not part of the aim of this research to establish

how different subject areas used technologies to support learning and teaching.

The pilot study recruited 28 people studying or working in HEIs as its participants. The participants were recruited by email invitation, and by postings on an online forum on a module taught by the researcher, with the consent of the Module Leader. The sample comprised 13 undergraduate students, 4 postgraduate students and 1 postgraduate researcher. Furthermore, the sample included 6 lecturers and 4 academic related staff.

The Phase I participants were a lecturer and a student taken from the pilot study sample. Both volunteered for interview following the pilot study. The same 2 participants featured in Phase III.

The Phase II participants consisted of fifteen undergraduate students, one postgraduate researcher, two lecturers and two academic related staff. In common with the first survey, participants were invited by email, and by a posting on a module forum, with the Module Leader's consent.

The observation participants (Phase IV) consisted of four students and three lecturers. For Phase V, the participants were invited by the researcher, by email, after having participated in an earlier phase of the research, having declared an interest in the research, and having declared a willingness to participate further. The participants consisted of a lecturer, a postgraduate

student, and an undergraduate student, thereby gaining perspectives from different roles within an academic community.

For the final phase (Phase VI), 67 participants were recruited. Participants were invited by email, and by postings on module forums, with the Module Leaders' consent, for modules taught by the researcher. In addition, an invitation to academic community members to participate was published in the researcher's blog (<http://idcharred.wordpress.com>), following clearance from the first supervisor. The survey responses showed that 29 participants were lecturers, 29 were students, and 7 stated they worked in academic support. The other 2 participants stated they were both postgraduate students and graduate teaching assistants.

The bulk of the participants across the whole research were lecturers or students. A smaller number of academic related staff, involved in student support or learning technology (roles entailing regular contact with students and lecturers) also participated. The breakdown of the participants as a whole is as follows: 69 were students, 41 were lecturers, and 13 were in academic related roles. Two participants, a lecturer and a student, featured in the pilot study, Phase I and Phase III. A HEI in this research was considered as a Community of Practice (Lave and Wenger, 1991; Wenger, 1998), with different roles contributing to collective aims.

3.4 Ethical Considerations

Participants in the research were given an information sheet concerning the research (see appendix 7). Moreover, the approach to ethical practice in this thesis is underpinned by the British Educational Research Association's *Ethical Guidelines for Educational Research* (2011). In addition, all data in this thesis has been anonymised. Furthermore, the research was approved by the Open University's Human Research Ethics Committee (ref: HREC/2011/#1074).

The research project did not open up any major ethical issues. Therefore, while observations were undertaken, they were not covert. The researcher sat in the room with the participants during the observations. Moreover, three of the observation participants were line managed by the researcher at the time the observations were undertaken. It is recognised that the presence of an observer may have had an impact on behaviour (Cohen *et al.*, 2000, p.316; Bryman, 2004, p.175). However, the researcher did not speak with the participants once the observations were in progress, and it was made clear to each participant that the observation did not relate explicitly to their professional role (i.e., it was not a pass/fail process, nor would the observation impact on appraisals, or any other performance measuring process).

The original intention had been to undertake the observations for one hour each. However, at the first trial the researcher's contemporaneous

handwritten notes became illegible, and the observation had to stop. The notes were not usable. A second trial of half hour produced similar results. The decision to undertake 15 minute observations enabled legible, usable, handwritten notes to be taken, and typed up subsequently (see Appendix 4). Moreover, it was found to be the case that each participant's preferred method for gathering data was apparent very quickly; participants had a preferred method which they tended to reproduce across different searches. The overall approach to the observations was therefore valid, and produced usable data.

Two participants were interviewed for Phase I, and the same two participants were interviewed again after an interval of ten months (Phase III), to identify the extent to which they had used a technology to which they had been introduced by the researcher at the first interview. Both participants confirmed they had not heard of the technology before; these responses were consistent with information they had given in their responses to the pilot study survey.

3.5 Research Methods

The following research methods were used to gather and analyse research data -

The main methodology was qualitative, comprising interviews (to record declared practice) and observations (to record actual practice). However, there was also quantitative data from the surveys. This mixed-methods approach is appropriate because the research focuses on both the specific technologies being used to support learning and teaching (quantitative), and, more tellingly, how they are used (qualitative). Furthermore, Bryman (2006) argues that combining the two approaches offsets the potential weaknesses of each and, moreover, enhances the utility of the findings for practitioners and others. In addition, numerous methods of gathering data were employed “to provide corroboration and triangulation” (Cohen *et al.*, 2000, p.315); different research instruments created a range of data for analysis. Bryman (2006), in a survey of 232 social science articles, argued that a mixture of quantitative and qualitative approaches can be used successfully (p.101). His survey results showed that 82.4% of all articles under consideration used a survey (p.103), and 41.8% used a survey in conjunction with qualitative interviewing (p.104). There is therefore precedent for gathering data along the general lines pursued in this research and, moreover, employing both approaches enhances the integrity of the findings (Bryman, 2006). Furthermore, the mixed methods approach in educational research has been used consistently in the period 1995-2005 (see Truscott *et al.*, 2010) and is thus an established approach. In addition, Littleton and Mercer (2004) argue that the combination of quantitative and qualitative methods can complement each other. Moreover, Miaz (2008) argues for the mixed methods approach in education, provided the problem situation determines the methodology which is the case in this research, as the research analyses

the use of disruptive technologies, collecting data relating to participants' comments about their technology use, and their technology use in practice. Wanting to learn about what participants said they did and, separately, what they did, was conducive to the mixed methods approach.

The research procedure evolved, in the sense that each iteration of the research provoked or highlighted issues which were then investigated further *via* a different research instrument. The pilot study survey was exploratory, and was then nuanced through two interviews (Phase I) comprising more focused analyses of how technologies were used to support learning and teaching; richer data was obtained in a more conversational, face-to-face context. The pilot study survey also identified technologies that did not feature in the list of technologies presented to participants (the participants identified other technologies that they used), and therefore the survey was adapted for its second iteration (Phase II).

The re-interviews of the first interviewees (Phase III) sought to consider how technology use may change (thereby linking to Engeström [1987, 1999a, 2001], who defines contradictions as structurally evolving tensions accumulating over time). The observations allowed actual practices with technologies to be recorded, though the approach was structured (Bryman, 2004, p.167) rather than ethnographic. The approach was considered appropriate, however, as Hammersley (2003, p.119) cautioned against an over-dependence on interview data, and this thesis does seek to triangulate its findings through a mixed methods approach which, as Lavelle *et al.*

(2013) argue, is pragmatic; in this specific instance, the mixed methods approach is pragmatic, as the research is iterative and evolutionary, responding to findings as they emerged through the course of the research.

Final interviews for this research (Phase V) sought to analyse further how participants created purposes through usage (in line with Christensen and Raynor, 2003), while a final survey (Phase VI) elaborated upon ideas already emerging from the data, such as whether academic community members use a wide range of technologies to support learning and teaching, or demarcate their usage.

The final survey (Phase VI) was available to a more diverse constituency, being published on the researcher's blog with an invitation to academic community members in the UK to participate. As the focus for this research was on academic community members, the survey sought a range of academic community members, though with the majority being lecturers or students. The questions in the final survey sought further data on how specific technologies identified in previous phases of the research were used.

3.6 Data Protection

Data presented in this research has been anonymised. Survey responses, interview transcripts, and transcriptions of the observation studies are stored

on the researcher's home computer, and are password-protected. The final survey was issued via Bristol Online Surveys (<http://www.survey.bris.ac.uk>); only the researcher had the user name and password for the survey, and the participants were not compelled to give their names.

The research sites and the research sample both have implications for the research. That said, it was not the aim of this research to examine one specific institutional context closely, nor (at the other end of the scale) to encompass the entirety of the UK sector, but to consider how academic community members use technologies and, in particular, disruptive technologies, to support learning and teaching.

3.7 Data Gathering

Data were gathered about both declared and observed practice in relation to the use of disruptive technologies to support learning and teaching. Alternative means of gathering data were actively considered, such as focus groups, but it was judged, overall, that the combination of survey data, interviews and observation studies would be sufficient to investigate the research questions. Research with individuals rather than groups was deemed appropriate because the research focuses on how academic community *members* use technologies to support learning and teaching, rather than academic communities *per se*.

The questions for the pilot study related to the overarching research question by seeking to identify awareness and usage of technologies, and the purposes for which technologies were used, thereby exploring whether or not technologies were being used disruptively, and thus honing the research's understanding of disruptive technologies, as outlined by Christensen (1997). The pilot study survey sought data relating to the following questions (specific to the pilot study):

- What technologies are participants aware of?
- What technologies do participants use?
- What do participants use technologies for?
- To what extent do participants use technologies for more than one purpose?

A survey allowed for the gathering of baseline information, both to generate data for analysis and to inform the design of further surveys and other research instruments.

The data comprised tick box, closed-ended responses to some questions, including the use of a four point Likert scale (1932), and also featured longer, more open-ended responses to other questions. In addition to gathering baseline data about individuals' uses of technologies to support learning and teaching, the survey also enabled a perspective on the extent to which participants' uses of technologies could be described as disruptive,

the purposes for technology use arising from practice rather than design. The data were therefore relevant to the primary theoretical framework for the research.

Following the online survey, semi-structured interviews were conducted with two participants from the original sample (one lecturer and one student), who volunteered for interview (Phase I of the research). Conducting two interviews provided a limited data set, but did allow for data on how individuals used technology to support learning and teaching; the interviews also provided both a lecturer's and a student's perspective. The two participants were subsequently re-interviewed (after 10 months), comprising Phase III of the research.

The Phase I interviews were semi-structured (Bryman, 2004, p.326). Key themes for exploration were identified, for example the disruptive use of technologies, or potential contradictions between nodes in an activity system, but the interviews were effectively open-ended, enabling greater flexibility and further probing. The interview transcripts were coded (Bryman, 2004, pp.194, 408-09), in line with key themes, including the use of disruptive technologies, and tensions between nodes in an activity system (see appendix 3). Semi-structured interviews allowed the participants to articulate their uses of technologies in their own terms, with occasional questions from the researcher to steer the interviews towards areas of particular relevance, especially the extent to which their uses of technologies were disruptive. In addition to allowing for flexibility, the

semi-structured approach encouraged the researcher and interviewees to be co-constructors of meaning (Wood and Kroger, 2000, p.72), or co-researchers (Moustakas, 1994, p.110), exploring the disruptive potential of specific technologies.

In addition to the interview, both interviewees were introduced to a technology they had not used before, but not given guidance in how to use it. The participants' subsequent use of the technology was analysed in a further interview (Phase III) to trace if (and, if so, how) they constructed a purpose for a technology. The approach was related to Christensen and Raynor's (2003) argument, whereby objects (purposes) for technologies are created through practice. The approach was also related to second generation activity theory, by considering whether the use of the technology changed other aspects of the participants' learning and teaching practice.

For Phase II, the original survey was revised to include technologies that did not feature in the pilot study survey, but which were mentioned by some of the pilot study participants (e.g., You Tube, Skype and Survey Monkey). The Phase II survey was similar to the pilot study survey, in seeking both quantitative and qualitative data. This approach was adopted in order to establish awareness and usage of technologies, and to invite more reflective, open-ended responses. In common with the first survey, the second survey sought to identify uses of both established and emerging technologies. Moreover, the survey enabled some evaluation of the use of disruptive technologies, while also introducing Markides's (2006) interpretation of

disruption, as Markides sees disruption as not occurring in a vacuum, but shaped instead by effective marketing, and by established practice (Timmis [2012, p.12] also attributes students' uses of non-institutional technologies to established practice).

The two participants who were interviewed for Phase I were re-interviewed after a period of ten months, to investigate the extent to which their practices with technologies had changed in the interim, thereby producing Phase III of the research. A further, specific purpose of the Phase III interviews was to analyse how the participants had used the technologies to which they had been introduced in their first interviews. The interval between the two interviews gave sufficient time for the use of technologies to develop, thereby linking to the second generation activity system, as Engeström (1987; 1999a, p.381) argued contradictions between nodes in an activity system accumulate structurally over time. The approach to the re-interviews enabled a sense of how a purpose for a technology can emerge and develop through practice.

Seven observations were conducted (Phase IV). The participants were given a task concerning the identification and storage of information to support learning and teaching. Observations were undertaken because they enabled actual, *in situ* (if not fully ethnographic) practices with technologies to be recorded (Cohen *et al.*, 2000, p.305), and also enabled potentially disruptive uses of technologies to be identified. In addition, and incorporating an expansive learning perspective, observations enabled a perception of how

the division of labour in higher education may be changing, with participants not mediating their acquisition of knowledge through an HEI, but constructing knowledge more directly through their own interactions with tools for learning; an existing activity system is modified through the practices of subjects (academic community members) with tools (disruptive technologies) impacting on the division of labour (knowledge resources being accessed through means other than the HEI). This approach incorporated an expansive learning perspective by seeking potential contradictions within existing activity systems. The observations thus enabled the collection of data distinct from the surveys and interviews, by focusing closely on practice.

More specifically, *structured* observations (researcher's emphasis) were undertaken; the observations were structured in the sense that participants were given instructions on what to do, in the context of a time limited task. Bryman (2004, p.178) claims structured observations can be preferable to questionnaires, and may work best when accompanied by other methods, as is the intention of this research with its mixed methods approach. In addition, McCall (1984, p.277) claims observations provide more reliable information about events. Less favourably, observations may require a certain amount of interpretation on the part of the observer, and are rarely able to get at intentions behind behaviour (Bryman, 2004, pp. 170, 177). There is also a possibility of what Bryman calls "reactive effect," with participants modifying their conduct because they are being observed, but this, Bryman argues, should not be exaggerated (2004, pp. 175, 179).

Therefore, and on balance, while structured observations require a mediating level of interpretation on the part of the researcher, they also provide a valuable source of data, enabling practice to be recorded.

The observations for this research involved the researcher sitting in a room with each participant. Meeting rooms and classrooms were booked for the purposes of the observations. The researcher's own office space was eschewed, and all the computers used were on the HEI's network. All the participants were frequent users of the network. It is recognised that the researcher's presence and the relationship of the researcher to the participants (line manager, in some cases) may have had some effect on the observation, a phenomenon noted by Cohen *et al.* (2000, p.316) and underlined by Bryman who writes, "gaining access is also a political process" (2006, p.104). In practice, the researcher did experience limitations in gaining access to participants, exacerbated when he advised his then employers (Organisation 2) that he would be leaving their employment at the beginning of 2012.

Observations enabled an examination of how participants actually used technologies to support learning and teaching in higher education. While surveys record declared practices, it was felt that there could, potentially, be contradictions between declared and actual practices (the importance of observing what learners actually do with technologies is also noted by Timmis [2012, p.6], and Christensen *et al.* [2001] argued there is a difference between what students say they want, and what they actually do

with technologies to support learning). Relating the observations to the theoretical frameworks, the observations allowed the disruptive use of technologies to be recorded, and also allowed observation of the interactions between subjects, tools and objects, with implications for the division of labour in higher education, and for the higher education community.

Four of the participants were students, and were given the following task:

You have been asked to write an essay for assessment at a Higher Education Institution, concerning the issue of widening participation in Higher Education. Identify, gather and store relevant information for this essay, using only the computer in front of you. Do this for fifteen minutes.

The remaining three participants were lecturers, and were given the following task:

You have been asked to prepare a class on emergent forms of assessment in Higher Education. Identify, gather and store learning and teaching materials for this purpose, using only the computer in front of you. Do this for fifteen minutes.

The participants had been invited to participate in the observations by the researcher, by email. A further lecturer had been approached, thereby having an equal number of lecturers and students, but was unavailable on the day scheduled for observation, and it was not possible to arrange an alternative date before the researcher left the HEI's employment. Approximately equivalent numbers of lecturers and students were sought to

see if there was a discernible difference in technology use between the two constituencies (no difference was detected).

A further three, structured interviews (Bryman, 2004, pp.111-12), comprising Phase V of the research, were conducted in order to generate additional data, with participants who had completed the second survey, and/or had undertaken the observation study. Structured interviews were undertaken to investigate further the technologies participants used to support learning and teaching, and to probe how the participants gained competence in technologies and thus created purposes for technologies. The interviews also addressed the extent to which participants' experiences with technologies could be described as disruptive, by considering whether they preferred institutional or non-institutional technologies to support their learning and teaching.

Structured interviews were also undertaken in order to record participants' responses to specific questions related to the purposes for which technologies are used. The questions investigated ideas around disruption, as Christensen and Raynor (2003) modified the position presented originally by Christensen (1997) by arguing that disruption is not a design feature of a technology but, instead, emerges through practice. The questions related to disruptive technology and Disruptive Innovation by exploring the sources participants used to access and build knowledge. The questions relating to the purposes for which participants use technologies were asked because the initial surveys had suggested participants used technologies for more than

one purpose, while the observations had suggested that a narrow range of technologies are used to support information gathering and storage as an aspect of learning and teaching in higher education. In addition, looking at participants' purposes regarding technology use relates to the core research question and Christensen and Raynor's analysis (2003), by identifying potentially disruptive usage, and looking at how technology use supports learning and teaching in UK HEIs. The interviews were coded, identifying key themes, such as the use of sustaining and disruptive technologies, and participants demarcating their uses of technologies (as had been implied in the observations, with a narrow range for technologies being used to support learning and teaching).

Finally, a further survey was conducted (Phase VI). The questions asked related to disruptive technology and Disruptive Innovation by considering whether non-institutional technologies were used to support learning and teaching. Considering the use of non-institutional technologies also relates to Activity Theory and expansive learning because it implies participants are modifying the traditional division of labour by not routing their search for knowledge resources through technologies supplied by their HEI.

3.8 Data analysis

The analysis of the pilot study data focused, first, on raising awareness of disruptive aspects of non-institutional technologies in learning and teaching

and/or identifying usage of various technologies. This enabled a sense of the extent to which participants relied on established technologies, or were engaging with non-institutional, disruptive technologies. The technologies featured in the survey were a mixture of the established (e.g., Facebook) and the emergent (e.g., Wallwisher). The technologies specified in the survey were informed by the Horizon Report 2010, which argued for the importance of social networking technologies, as well as formal learning technologies. The Report also identified the emergence of newer tools enabling collaboration (Johnson *et al.*, 2010, p.4), for example Twitter and LinkedIn. These types of technologies featured in the survey, alongside established technologies for learning and teaching.

The pilot study survey data also sought to identify the technologies that were used most widely, from the list provided (Appendix I). This approach was adopted in order to investigate ideas around disruption, whereby the purposes to which people apply technologies do not necessarily conflate with designer's intentions, and whereby a network of users of a particular technology emerges through practice (Christensen and Raynor, 2003).

The Phase I interviews were analysed in order to identify and begin to probe key themes, such as disruptive technology use, purposes being established through usage, and potential contradictions between nodes in an activity system. The primary objective of the interviews was to test Christensen and Raynor's (2003) ideas on disruption, exploring the extent to which purposes arise from usage rather than from design. The transcripts were read through

repeatedly to develop a sense of their value in relation to the research questions (Langridge, 2007, p.88). The interviews were then coded to enable the identification of recurrent practices in relation to technology use. Evidence of disruptive technology use was sought, and identified in the sense that the participants created purposes for technologies through usage. The impact of technology use on other aspects of learning and teaching was also considered.

The findings from the first interviews (Phase I) suggested the participants constructed purposes for technologies through their use of them, and that purposes created by users did not necessarily conflate with designers' intentions. For example, one interviewee stated, "You could watch five thousand tutorials on Twitter and I still don't think you would get it. You have to capture your own purpose in using it." In this sense the interviews echoed the core tenets of Disruptive Innovation, with a user creating a purpose for a simple, convenient, easy to use and free technology, through their practice.

The second survey (Phase II) added technologies to the list presented to participants in the pilot study, but did not produce substantially different results. In common with the first survey, the data were analysed to identify which technologies had high levels of awareness and usage, and which had low levels.

Only a small number (five) of the second survey participants used LinkedIn (for work), but four also used LinkedIn for recreation, and four for informal learning. The findings for the second survey thus largely reproduced the findings of the first survey, in the sense that participants shaped their own purposes for technologies, in line with Christensen and Raynor (2003). Individual technologies were deployed for a wide range of tasks. However, participants in both surveys seemed to rely on a few technologies for a wide range of purposes, suggesting demarcation in the use of technologies to support learning and teaching. Disruptive use seemed to be concentrated in a small hub of technologies, rather than distributed across technology usage more widely. In addition, participants were using well known technology brands, such as Facebook, Wikipedia and You Tube, opening up the possibility that successful marketing (Markides, 2006) played a part in the technologies used.

Further evidence of disruptive technology use was sought in the second survey (Phase II), and was identified in, for example, the widespread use of Wikipedia, which is simple, easy to use, more convenient and cheaper (free, in fact) than other encyclopaedias, in line with Christensen's definition of disruptive technologies (1997, p.xv). From an expansive learning perspective, the survey also examined how subjects were using the plethora of technologies available, thereby managing the tools node within an activity system, and it appeared that participants were using a small range of technologies for a wide range of tasks, with one participating stating, "Adding too many technologies to support teaching/learning, especially

where one or two can do the job, can overwhelm the student (and the educator!)” A potential contradiction between subjects (individual learners and teachers) and tools (technologies) was resolved by subjects through the use of technologies that are simple, easy to use, convenient and (ideally) free, thereby incorporating the two, core theoretical approaches for this research.

The re-interviews of the February 2011 interview participants (i.e., Phase III) were analysed to revisit the key and recurrent themes evident in the first interviews (Phase I), relating to disruptive technology usage, and potential contradictions between subjects and tools. The same features of technology use persisted, with participants establishing purposes for technologies through usage. The re-interviews also analysed the extent to which each participant had created a purpose for a new (to them) technology. Further evidence of disruptive technology use was sought, to see if (and if, how) participants had created a purpose for a specific technology which conformed to one or more of Christensen’s (1997) criteria for a disruptive technology. Wallwisher (online notice board) is simple, easy to use, convenient and free, but it may also be a limited tool, and thus distinct from Google, Wikipedia and Delicious, which are more obviously multi-purpose.

The data from the observations (Phase IV) were compiled by recording the participants’ practices by hand, taking contemporaneous notes which were then transcribed; an example of a specific observation study is included in the appendices (Appendix 4). The intention of the observation studies was

to foreground the participants' actual, physical practice, recording what they did as they did it. The data were analysed primarily to identify the participants' preferred method for gathering and storing information to support learning and teaching, and to see if they were relying predominantly on institutional or non-institutional sources. In practice, each participant had a method, which they reproduced, changing search terms on Google but not changing their method.

The observations showed a small range of technologies being used to support learning and teaching, suggesting that a contradiction between subjects (individual participants) and tools is resolved by subjects by selecting simple, convenient, easy to use and free technologies, thereby bringing together Engeström's activity system (1987), and Christensen's definition of disruptive technologies (1997, p.xv).

For the structured interviews (Phase V), all three participants were asked the same questions, to see if there were differences between the ways individuals holding different roles in an academic community used disruptive technologies (no significance difference was detected). The interview findings indicated significant demarcation in technology use, and reproduced previous findings in the research by showing that the participants were self-taught in their use of technologies, establishing purpose through usage. The three participants stated that they demarcated their use of technologies, using different technologies for learning and teaching than for socialising, notwithstanding the potential of the

technologies used for socialising to support learning and teaching. This goes against the earlier survey findings, which suggested that participants do use technologies for more than one purpose. The contradiction is between subjects (participants) and tools (technology); subjects prove resourceful, managing the contradiction through self-selection and demarcation, pursuing different objects (educational on the one hand, and social on the other) through different technologies (Timmis [2012, p.9], also notes users demarcating their uses of technologies).

For the final survey (Phase VI), the data were analysed to identify technologies that were used most widely. The data were also analysed to identify the extent to which participants were using social networking technologies to support their learning and teaching. The findings suggested that participants do not use social networking technologies to support learning and teaching, contrary to the position taken by Junco *et al.* (2010) in their study of Twitter usage on one course, though it is notable that a conscious attempt was made in the course they studied to integrate Twitter into learning and teaching. Phase VI suggested that participants' means of accessing knowledge resources to support their learning and teaching are weighted towards non-institutional sources.

The data for Phase VI were related back to the core theoretical frameworks, to identify disruptive usage and to analyse the impact of technologies (tools in activity system terms) on other nodes. Instances of disruptive technology

use were sought, as was evidence that disruptive technology use was impacting on the academic community.

A summary of the research design showing research phases and instruments used to support investigations is presented below.

Table 3.1 Research phases and research instruments

Research Phase	Research Instrument
Pilot Study	Survey no. 1
Phase I	Semi-structured interviews
Phase II	Survey no. 2
Phase III	Semi-structured re-interviews of the Phase I participants
Phase IV	Observation Studies
Phase V	Structured Interviews
Phase VI	Survey no. 3

The table indicates that the research activities were iterative, building upon each other and subject to development as each iteration was undertaken. Furthermore, different kinds of activities were undertaken in order to collect different kinds of data.

3.9 Conclusion

The thesis used a range of research instruments. Surveys (the most frequently used instrument) proved successful for generating baseline, quantitative data relating to the use of technologies to support learning and teaching in higher education, and enabled numerical comparison (Littleton and Mercer, 2004, p.196). The survey showed which technologies from the list were well known, and used. Furthermore, the surveys generated qualitative data in participants' more reflective responses.

Observations were useful because they enabled a sense of how technologies are being used to support learning and teaching to be demonstrated through practice; the same phenomenon occurred in Scanlon and Issroff (2005), though their study was ethnographic rather than a structured observation. Notwithstanding the researcher's presence and its reactive effect (Bryman, 2004), observations for this research indicated that individual participants have their own practices and patterns for gathering and storing information to support learning and teaching. Interviews, both structured and semi-structured, generated further data concerning how participants learned to use and then applied technologies to support learning and teaching. The final survey ratified some of the core findings relating to technology use, especially the limited impact of social networking technologies in learning and teaching, and the extent of participants' use of non-institutional technologies to support learning and teaching.

The use of two institutions for much of the data limits the generalisation of the findings. However, the approach also enabled the researcher to conduct a more focused study making it possible to analyse socio-cultural and contextual issues around technology use. The presence of the researcher in the room when the observations were undertaken may also have had an effect on participant behaviour although there was no direct interruption by the researcher. The researcher's presence was necessary to take note of cultural norms that were evident in practice. Furthermore, the data as a whole, derived from different research instruments and a mixed method of quantitative and qualitative approaches (with the emphasis on the latter, and thereby using qualitative data to illustrate quantitative findings [Bryman, 2006], and to develop those findings) enabled an analysis of disruptive technology use, and its impact on other component parts of higher education communities in the UK. In addition, the mixed methods approach provided a more comprehensive account of the area of enquiry, achieving some completeness (Bryman, 2006). Moreover, the evolutionary, iterative nature of the individual research activities enabled the foregrounding of specific issues emerging from the data. The suggestion, from the earliest iterations, that participants were using a range of (albeit established) technologies was challenged by the observations which suggested only a narrow range of technologies was used to support learning and teaching. This finding was underlined by the final survey, which showed that participants were not using social networking technologies to support learning and teaching. While initial survey data had suggested participants were blurring boundaries and using some technologies for both learning and teaching on

the one hand, and recreation on the other, the richer data emerging later indicated that academic community members were more likely to demarcate their uses of technologies, and to use a small range of technologies to accomplish a wide range of tasks.

The table below builds upon table 3.1, to demonstrate the research timeline and the kind of data gathered, thereby summarising the framework for the core content of this chapter, and the structure and evolution of the research.

Table 3.2 Research timeline

Research Phase	Duration	Number of Participants	Methodology
Pilot Study	November 2010 – March 2011	28	Quantitative and qualitative
Phase I	February 2011	2	Qualitative
Phase II	October 2011 – December 2011	20	Quantitative and qualitative
Phase III	December 2011	2	Qualitative
Phase IV	October 2011 – November 2011	7	Qualitative
Phase V	December 2012	3	Qualitative
Phase VI	September 2012 – January 2013	67	Quantitative and qualitative

The table highlights the iterative nature of the research, and also highlights the mixed methods approach, weighted towards qualitative approaches. In practice, the qualitative approach yielded richer data for analysis, and enabled conclusions to be drawn about the use of disruptive technologies to support learning and teaching in higher education.

Having reviewed the study design and research methodology, the next chapter examines the pilot study, which generated the first data for analysis.

CHAPTER 4: PILOT STUDY

4.1 Introduction

The previous chapter detailed the study design and research methodology. This chapter begins to engage more substantively with the actual research undertaken, by honing in on the pilot study. In order to obtain a first set of data about the use of disruptive technologies, a pilot study was conducted to find out what technologies were being used by academic community members, and how they were being used.

The overall aim of this research is to understand how HEIs in the UK can engage constructively with disruptive technologies for learning and teaching. The complexity of the core question required it to be broken down to the following sub-research questions, which were specific to the pilot study:

- what technologies are participants aware of?
- What technologies do participants use?
- What do participants use technologies for?
- To what extent do participants use technologies for more than one purpose?

The questions for the pilot study related to the core research question by seeking to identify awareness and usage of technologies, and the purposes for which technologies were used. Finding out more about the use of disruptive technologies was necessary to form an understanding of how HEIs can engage constructively with disruptive technologies.

4.2 Study Participants and Context

The pilot study recruited 28 people studying or working in HEIs as its participants. The participants were recruited by email invitation, and by postings on an online forum on a module taught by the researcher, with the consent of the Module Leader. The sample comprised 13 undergraduate students, 4 postgraduate students and 1 postgraduate researcher. The sample also included 6 lecturers and 4 academic related staff. Information was not sought on the age or gender of the participants, as this was not an area of exploration for the research.

4.3 Investigation Procedure

A survey, issued online because of the geographical diversity of the sample (some of whom did not meet the researcher face to face), allowed the gathering of baseline information, both to generate data for analysis and to inform the design of further surveys and other research instruments. The

baseline data related to the technology tools being used (i.e., specific technology tools being used by participants), and the purposes for which the tools were used (more precisely, divisions between tools used for learning and teaching, and for other objects [purposes]).

In addition to gathering baseline data about individuals' uses of technologies to support learning and teaching, the survey also enabled a perspective on the extent to which participants' uses of technologies could be described as disruptive, the purposes for technology use arising from practice rather than design: the data were therefore relevant to the primary theoretical framework for the research (Christensen, 1997; Christensen and Raynor, 2003). In addition, the data were also considered from an activity system perspective, examining the way knowledge resources are accessed and used.

4.4 Data gathering

The data comprised tick box, closed-ended responses to some questions, including the use of a four point Likert scale, a method which enabled differentiation of response (Cohen *et al.*, 2000, p. 253), and longer, more open-ended responses to other questions. The closed-ended questions enabled the gathering of more quantitative data, while the open-ended questions yielded more qualitative data, with participants able to give longer responses. The survey was issued *via* an email attachment, and returned *via*

the same route. The combination of different types of questions was appropriate because the pilot study survey was interested in gathering a range of data to inform further research instruments. Furthermore, by producing both quantitative and qualitative data, the survey adopted a mixed methods approach, which continued to be used in the main part of the research.

4.5 Data Analysis

Methods used to analyse qualitative and quantitative data gathered included collating figures on which technologies were being used, and on the types of technologies which were being used frequently. The analysis of the data therefore focused, first, on collating the numbers of participants who were aware of and/or used various technologies. This enabled a sense of the extent to which participants relied on established technologies, or were engaging with emerging, potentially disruptive technologies.

The analysis of the pilot study survey data also focused more closely on the technologies that were used most widely, such as Wikipedia and Facebook. This approach was adopted in order to investigate Christensen's ideas around disruption (Christensen, 1997; Christensen and Raynor, 2003), whereby the purposes for which people apply technologies do not necessarily coincide with designer's intentions, and whereby technologies that are cheap (often free), small, simple and easy to use are more likely to

be used. It became clear from the analysis that already well-established technologies were well known and used, whereas newer, potentially disruptive technologies tended not to have been heard of by the participants. The open-ended questions produced more complex responses, and analysis of these considered why participants opted for some technologies, for example Wikipedia, in preference to others.

4.6 Findings

The technologies featured in the survey were a mixture of the established (e.g., Facebook) and the emergent (e.g., Wallwisher), to obtain a sense of the extent to which different technologies were being used. The technologies specified in the survey were informed by the Horizon Report 2010 (Johnson *et al.*, 2010), which argued for the importance of social networking technologies, as well as formal, institutional learning technologies. The Horizon Report also identified the emergence of newer tools enabling collaboration. These types of technologies (e.g., Twitter and LinkedIn) featured in the survey, alongside established technologies for learning and teaching.

The results of the pilot study survey suggested there are considerable variations in awareness of technologies. For example, twenty-one participants had not heard of emerging technologies such as Wallwisher (online notice board), Xtranormal (animation software) or Prezi

(presentation software), and thirteen participants had not heard of Delicious (online bookmarking service). Participants also mentioned technologies that did not feature in the survey, including You Tube, Skype, Second Life, Elluminate and Survey Monkey. The survey itself was subsequently revised (Phase II).

The findings also showed technologies being used for more than one purpose. For example, Facebook was used for recreation by 16, but also for work (7) and informal learning (3 participants), with informal learning signifying learning not undertaken in the context of a formal course. Twitter was used for recreation by 10 participants, but also for work (7) and informal learning (5). That said, neither technology was being used for formal learning. These initial findings tended to support the idea that technologies were blurring boundaries between learning and teaching and recreation (Conole *et al.*, 2008), though subsequent iterations of the research indicated otherwise (see chapters 5 and 6). Moreover, the survey was not designed to probe further the kind of informal learning taking place; the survey did not enquire into whether the informal learning was linked to formal learning the participants were undertaking, or whether it was more closely aligned with recreation.

The findings from data about Wikipedia indicated its ubiquity. Twenty-one participants used it for recreation, 20 for informal learning, 15 for formal learning, and 16 for work. One participant wrote, “Wiki[pedia] often comes up as the first port of call for quick research, but due to it’s [sic]

unreliability I would usually try to corroborate any information found there.” Another participant wrote, “I wouldn’t blindly trust the articles themselves as reliable sources of information” and a further participant wrote, “I’m always wary about the veracity of the information.” It is noteworthy that the use of Wikipedia is not prevented by its perceived (by a number of the participants) unreliability, as it is a readily available tool to serve a purpose, and has a role within a second generation activity system. A potential tension between the tool (Wikipedia) and the object (successful learning experiences and outcomes) is managed by subjects (participants), using the tool because it is free, simple, easy to use and convenient, in line with Christensen (1997), but with the subjects (participants) not accepting the veracity of the tool as a matter of course. The tool is seemingly accepted and utilised because it is sufficient to get a job done.

The findings for specific questions are shown in Tables 4.1 and 4.2, which illustrate quantitative findings from the pilot study.

Table 4.1 Responses to question 1, “please indicate, by ticking ‘yes’ or ‘no’, whether you have heard of the technologies listed. If you have heard of the technology and have also used it, please put a tick in the third column.”

	Yes	No	Have used
Bebo	23	5	4
Blackboard Web CT Virtual Learning Environment	17	10	8
Del.icio.us	14	13	8
Facebook	27		22
LinkedIn	23	5	13
Moodle Virtual Learning Environment	17	11	13
MySpace	25	2	5
Other Virtual Learning Environment [9 participants did not respond to this question]	17	2	14
Prezi	5	21	3
Twitter	28		16
Wallwisher	4	24	4
Wikipedia	27		25
Xtranormal	3	25	2

Table 4.2 Responses to Question 2, “please indicate how you have used the technologies. Feel free to tick more than one box for each technology, if applicable. If it is a technology you have not used, please leave that row blank.”

	Work	Recreation	Formal Learning	Informal Learning
Bebo		3		1
Blackboard Web CT	4		6	1
Del.icio.us	6	3	3	1
Facebook	7	16		3
LinkedIn	7	5		3
Moodle	8		10	5
MySpace		4		1
Other Virtual Learning Environment	7		12	3
Prezi	2			1
Twitter	7	10	2	5
Wallwisher	1	2	1	
Wikipedia	16	21	15	20
Xtranormal	2			

The tables show that established technologies are well known, but emerging technologies far less so. Furthermore, some technologies are used widely for more than one purpose, Wikipedia being the most obvious case in point. All of the technologies were used for at least one purpose, with Xtranormal being used least (for work, by two participants). Moreover, awareness of a

technology does not correlate with usage, in the sense that only two of the listed technologies were used by over twenty out of the sample of twenty eight, and some technologies with widespread awareness (Bebo and My Space) were used by only a small number of the participants. Table 4.2 shows technology being used for more than one purpose, but often weighted towards a particular purpose. The exception is Wikipedia, which is used for a range of purposes, and is used widely, and conforms to Christensen's (1997) criteria, including its having challenged rival, printed encyclopaedias, which are sustaining technologies, offering marginal improvements within an established publication format.

The best known technologies in the survey were designed for social networking (e.g., Twitter, Facebook and MySpace), though Wikipedia was also well known. However, while most of the well known technologies were also used extensively, this did not apply to MySpace. One possible explanation for this is the decline of MySpace, which was unable to sustain its community of users when a rival social networking technology came along in the form of Facebook which, by 2009, had overtaken MySpace in terms of its number of users (Robards, 2012); in general, a Facebook page is easier to populate than a MySpace profile. Facebook is thus simpler and more convenient than MySpace (Christensen, 1997), which may go some way towards explaining its displacement of MySpace as a leading social networking technology

When the pilot study survey participants were asked about technologies used for formal learning, Wikipedia was used more than VLEs, suggesting, in Christensen's (1997) terms, that a disruptive technology was preferred to a sustaining technology, with Wikipedia being simpler, more convenient, and easier to use, having a simple interface and one search box. Conversely, accessing a VLE involves, customarily, logging-on to an HEI's home page, and then moving through further links to get to the resource.

4.7 Conclusion

The pilot study had set out to generate data on the technologies being used by academic community members, and the purposes for which technologies were being used. Certain, potentially disruptive technologies were being used widely. For example, Wikipedia seemingly acted as a hub for a range of information and a range of purposes, depending on what the user wanted to achieve (what object they wanted to accomplish), as it was used widely for work, recreation, formal learning and informal learning.

In addition, Wikipedia has displaced, or at least challenged, more established encyclopaedias, which are sustaining technologies updating their knowledge along existing lines and publication formats, but finding it difficult to compete with a rival encyclopaedia which is free, and available to anyone with access to a networked device. One participant stated, in response to an open-ended question in the pilot study: "The biggest

advantage of Wikipedia is that the answers are at your finger tips, you can ask a question and the answer appears without the need for flicking from chapter to chapter in a book.” Christensen argues that products based on disruptive technologies are cheaper, simpler, smaller and more convenient than their rivals (1997, p. xv), and Wikipedia clearly meets these criteria. In addition, and as a tool in a second generation activity system, Wikipedia can create a tension with the existing division of labour in an HEI, as it comprises a route to knowledge without mediation through an HEI’s own resources. Subjects can interact with the tool, without the intervention or steerage normally deriving from the traditional division of labour in higher education. The interaction between subjects and tools in this instance can also have implications for the rules node of activity system, if it leads to the submission of work for assessment that has arisen from the interactions of a subject and a disruptive technology.

More broadly, the pilot study indicated widespread awareness of some technologies, but very little awareness of others. Markides’s (2006) analysis of marketing in relation to Disruptive Innovation may be useful in this regard, implying that certain technology brands are more impactful than others, and that users have favourite brands. If an existing technology accomplishes a user’s object, there is little incentive to use another unless a technology arises that is simpler, more convenient, easier to use and cheaper than the existing technology.

Having reviewed the pilot study, the next chapter embarks upon the main study. The pilot study indicated that learners and teachers develop their own ways of using technology (in pursuit of their own objects), usages which can be contrary to the purpose for which the technology had been designed. This observation required further and more detailed investigation into academic community members' practices with technologies in order to understand how technology usage practices emerged and evolved over a period of time. The main study also sought more detailed information on how participants acquired purposes for technologies, and sought further information on what technologies were used, and for what purpose.

CHAPTER 5: MAIN STUDY – PHASE I, II & III

5.1 Introduction

The pilot study produced data pertaining to the use of technologies to support learning and teaching, and for other purposes. Consequently, the next steps of the research sought richer, qualitative data to investigate how participants used technologies, and the purposes for which they used technologies, thereby connecting more closely with Christensen and Raynor's (2003) reading of disruption. Following the pilot study (the subject of the previous chapter), interviews were undertaken with two volunteer participants from those who had completed the survey.

Therefore, this chapter comprises a review of the first three phases of the main research. Semi-structured interviews (Phase I), were followed by a modified survey (Phase II), and re-interviews of the Phase I participants (Phase III). The chapter reviews all three phases, placing the findings within the overall theoretical frameworks. The chapter uses the data produced to suggest that participants used a narrow range of technology tools to accomplish tasks, relative to the range of technologies available, either institutionally or non-institutionally. The chapter also suggests that disruptive technology use occurred, with purposes for technologies being

established through usage (Christensen and Raynor, 2003). Each of the individual research iterations are discussed in turn below.

5.1.1 Study Phase I - interviews

In Phase I, the key focus of the study was to gain qualitative data about technology usage. Given that pilot study findings had suggested that a small range of technologies was used for a wide range of purposes, it was felt that interviews would yield further insights into practices with technologies. The participants talked about their experiences with technologies from the perspectives of lecturer and student, in semi-structured interviews (Bryman, 2004, p.326). Both participants were later re-interviewed, to examine developments in their technology use over time (Phase III). The interviews were framed primarily by Christensen and Raynor's (2003) ideas on disruption, exploring the extent to which purposes arise from usage rather than from design, thereby underpinning the core research question of the thesis by better understanding the use of disruptive technologies to support learning and teaching in higher education, and building iteratively upon the data yielded by the pilot study.

More generally, the Phase I interviews served the aim of this research by exploring technology use to support learning and teaching, as expressed by two academic community members occupying different roles, with

particular emphasis on the extent to which their usage could be described as disruptive.

5.1.2 Study sample and context

One of the Phase I participants was a lecturer at both a campus HEI, and an HEI offering on campus and distance learning. The other Phase I participant was a learning technologist and also a postgraduate student, studying by distance learning. Both had participated in the pilot study. Both interviews took place at the researcher's place of work, in an office booked for the purpose (i.e., not the researcher's own office). Both participants were female; their ages were not recorded; differentiation of technology use by gender and age was outside the scope of the research.

In addition to the interview, each participant was introduced to a technology, but not given instruction in how to use it. Their subsequent use of the technology was investigated in a further interview (Phase III) to trace if (and, if so, how) they constructed a purpose for a technology over time.

5.1.3 Investigation procedure

The investigation procedure of this phase of the research was related to Christensen and Raynor's (2003) argument, whereby objects (purposes) for

technologies are created through practice. The investigation procedure was also related to the second generation activity system, by considering whether the use of the technology changed other aspects of the participants' learning and teaching practice. Conducting two interviews provided a limited data set, but did allow for data on how individuals use technology to support learning and teaching; the interviews also provided both a lecturer's and a student's perspective.

Key themes for exploration were identified, for example the disruptive use of technologies, or potential contradictions between nodes in a second generation activity system, but the interviews were effectively open-ended, enabling greater flexibility and further probing. Interviews allowed the participants to articulate their uses of technologies in their own terms, with occasional questions from the researcher to steer the interviews towards areas of particular relevance, especially the extent to which the participants' uses of technologies were disruptive.

5.1.4 Data gathering

The method used to gather data in this phase of the research was to conduct semi-structured interviews. The interviews were recorded by the researcher, by hand, and subsequently transcribed. The transcriptions were referred back to the participants, to ensure they were happy with the accuracy of the transcriptions. Semi-structured interviews allowed for the exploration of

specific aspects of each participant's practice, such as the use of VLEs and the use of social networking technologies. Semi-structured interviews also allowed the participants to reflect on how they had become proficient in certain technologies. In addition, semi-structured interviews allowed the participants to talk through specific learning and teaching situations where technology was involved, thereby giving a more developed sense of the uses of technology to support learning and teaching.

5.1.5 Data analysis

The analysis of the interviews focused on identifying evidence of disruptive usage, and on how the disruptive use of technologies could be analysed from a second generation activity system perspective. Coding (Bryman, 2004, pp.194, 408-09) enabled key categories to emerge, such as purposes for a technology tool being achieved through usage, which related explicitly to Disruptive Innovation in the sense that the analysis identified the extent to which purposes for technologies were obtained through practice. The interview transcripts were related back to the second generation activity system to identify potential contradictions between nodes. Contradictions were sought between nodes in a second generation activity system, in order to link the interview transcripts to second generation Activity Theory, as discussed in chapter 2. The analysis of the participants' practice was also related to how technology use might be influencing social relations in learning and teaching. The interview data were also coded in order to enable

the identification of recurrent practices in relation to technology use.

Therefore, and by these means, the interview transcripts were related back to core theoretical frameworks.

5.1.6 Findings

The interview findings suggested the participants constructed purposes for technologies through their use of them, and that purposes created by users did not necessarily conflate with designers' intentions. For example, the interview with the lecturer recorded three instances, via coding, of purpose being created through usage. The interview also referred to her experiences teaching at a campus university, where students can post materials on the VLE:

Q. Instead of all the learning and teaching resources at the [name of HEI] coming from you – some of them maybe posted by you, but essentially coming from the students - how do you feel about that?

A. I think it's absolutely brilliant because they're engaging in that process. And they're not just waiting to be spoon fed. They're actually actively seeking materials and they're sharing it with everyone else.

In this instance, a VLE is being used to enhance learning and teaching by producing active learning on the part of the students. The division of labour within the second generation activity system changes and becomes less

hierarchical, but the lecturer works with the change, to the benefit of the learning situation as a whole. A contradiction, in an activity system, between the tool's use (a VLE, in this instance) and the division of labour is resolved through the willingness of the lecturer to not always be the individual making knowledge available. In total, the lecturer's interview included five instances of potential contradictions between nodes in an activity system, suggesting the potential for disruptive technology use to influence other aspects of learning and teaching, because the disruptive use of the technology tool is consequential, as it impacts on social relations in learning and teaching. In a further example, the participant talked about technology having changed her interactions with students, as they (the students) expected learning materials online. The contradiction is between the tool (technology), the community (the students and their expectations) and the subject (the lecturer), having to change her teaching practice in order to resolve the contradiction.

In addition, it is noteworthy that the VLE is an effective learning platform in this example. VLEs are, arguably, sustaining technologies, relocating the components of face-to-face teaching to the online environment, without factoring in the deterministic effect of the medium itself. However, in this example the VLE demonstrates features of disruption by being a convenient platform, and by creating new possibilities through practice (Taylor, 2003, p.8). These findings are in line with Fry and Love (2011), who conducted interviews with nine lecturers who adopted a more conservative approach to the VLE, using it as a one way communication medium, and thus not

enabling its disruptive potential. Both cases suggest purpose is a result of usage. In addition, there is a possibility for expansive learning (Engeström, 1987), as a VLE is partly democratised, modifying the traditional division of labour within the academic community, with the students not being the recipients of the lecturer's sole expertise. However, the lecturer is responding positively to the less vertical division of labour, and thus enhancing learning for the community as a whole (the same practice was noted by Scanlon and Issroff [2005]). Engeström and Sannino (2010) argue that expansive learning starts with the questioning of an accepted and established practice (though Young [2001], using Activity Theory in a work based learning environment, argued that questioning can be perceived as trouble making), which may in this case be seen as the central role of the lecturer. The technology itself is not necessarily disruptive, as the VLE as a technology in practice often tends to replicate the conditions of a face-to-face class, as was noted by Blin and Munro (2008). However, while the VLE may not be disruptive axiomatically, the practice is disruptive in this instance, as learning materials are coming from students, not the lecturer. In second generation activity system terms, a tension between the tool and the division of labour is resolved through the accommodating approach of the lecturer.

The lecturer spoke about her own experiences with technologies outside work and, specifically, her experiences on LinkedIn.

Q. Would the fact that LinkedIn nominally declares itself as a

professional networking space, create awkwardness in the way that it is used ... just for more orthodox social networking?

A. No, there isn't actually. An interesting point because with the two people I am connected with, one is a violin teacher, so with my children, it's quite useful as I then get links to further professional contacts with her, in fact have tracked down a violin shop. So that has been a useful connect which I probably wouldn't have had that discussion with her if I hadn't seen who else she was linked in with.

The participant uses LinkedIn for a purpose other than its declared purpose, to support family life rather than professional life, but without any sense of transgression or protracted reflection. The technology serves a personal purpose, and has thus acquired a meaning through usage, in line with the definition of disruption offered by Christensen and Raynor (2003). From an activity system perspective, and as a tool, LinkedIn can cross from a professional to a social and personal activity system (Engeström, 1999a).

The second participant, a postgraduate student and learning technologist, talked about her experiences with Twitter, which coincide with the findings of Conole *et al.* (2008), in the sense that trial and error is more common and more productive than formal training:

You could watch five thousand tutorials on Twitter and I still don't think you would get it. You have to capture your own purpose in using it... you have to

actually use it before you begin to see
the value in it.

This is in line with Engeström's view; the epistemic value of a tool is not determined wholly by its design: "the material form and shape of the artefact [tool] have only limited power to determine its epistemic use" (2007, pp. 34-35). Usage creates purposes, the position also taken by Christensen and Raynor (2003). The participant eschews instruction materials or a steep learning curve, and instead creates her own purposes for easy to use technologies. In addition, Twitter can be seen as a disruptive technology in this instance because it conforms with Christensen's core criteria (1997, p. xv). Moreover, for the participant, it has acquired a purpose through its usage rather than design features (Christensen and Raynor, 2003). In second generation activity system terms, the interview suggests there is a potential contradiction between the subject (student) and the tool (Twitter), because the tool's purpose can, according to the participant, only be attained through practice, which will not be the same for each individual subject. The possibility for expansive learning arises if the learning situation is reconfigured to accommodate and even to encourage use of the non-institutional technology, enabling students to use the same tool in different ways in pursuit of the same object (successful learning experiences and outcomes).

The two interviews provided some evidence of purpose being obtained through practice (e.g., the use of Twitter), in line with the position taken by Christensen and Raynor (2003). Furthermore, the interviews provided some

evidence of technologies having the potential to influence the division of labour (in second generation activity system terms), with students locating the resources and making them available to their peers, albeit with the lecturer's partial intervention. While this is not necessarily innovative in learning and teaching, the ease with which students can be co-constructors of knowledge is enhanced through the existence of simple, easy to use and cheap (generally free) technologies (Christensen, 1997).

Following the interviews, a second survey was issued, modified following the first survey (incorporating technologies not listed in the first survey) in order to gain more data about technology usage. The second survey (Phase II) is summarised in the next section.

5.2 Study Phase II – second survey

5.2.1 Introduction

With the Phase I interviews giving a sense of how technologies were being used, the second survey (Phase II) supported the research aim of understanding how HEIs in the UK can engage constructively with disruptive technologies for learning and teaching by seeking to identify disruptive technology use, and by seeking to understand which non-institutional technologies were being used to support learning and teaching. The second survey also investigated whether people were using a wide

range of technologies to support learning and teaching, or demarcating their usage.

5.2.2 Study sample and context

The original, pilot study survey was revised for Phase II, to include technologies that did not feature in the pilot study survey, but which were mentioned by some of the pilot study participants (e.g., You Tube, Survey Monkey, Skype). Twenty surveys were returned in Phase II by fifteen undergraduate students, one postgraduate researcher, two lecturers and two academic related staff. None of the student participants was from the first sample, as a new academic year had commenced, with new cohorts. The same HEIs were used, and participants were studying or teaching the same modules as had been the case in the pilot study survey. By including academic community members from different roles, the research adhered to the idea of an HEI community as a Community of Practice (Lave and Wenger, 1991; Wenger, 1998). In common with the first survey, participants were invited by email, and by a posting on a module forum, with the Module Leader's consent. Information was not sought on the age or gender of the participants, as this was not an area of exploration for the research.

5.2.3 Investigation procedure

The survey was similar to the pilot study survey, in seeking both quantitative and qualitative data. This approach was adopted in order to establish awareness and usage of technologies, and to invite more reflective, open-ended responses. In common with the first survey, the second survey sought to identify uses of both established and emerging technologies. The survey also looked for potential conflicts between nodes in a second generation activity system, as a secondary aim.

Moreover, the survey enabled some evaluation of the use of disruptive technologies, while also introducing Markides's (2006) interpretation of disruption, as Markides sees disruption as not occurring in a vacuum, but shaped instead by effective marketing. The survey also related disruptive usage to established practice, as Timmis (2012, p.12) attributes students' uses of non-institutional technologies to existing, established practice. In this sense disruption is informed by existing practices.

5.2.4 Data gathering

The primary method for the survey (Phase II) was to ask questions concerning the awareness and uses of specific technologies. Participants were also invited to cite other technologies they used. Participants were also asked about the technologies they used most frequently for learning, work

and recreation. Moreover, participants were asked if they had introduced others to technologies. Finally, participants were asked if they had ever found a technology to be of no use in practice. Questions 1 and 2 gave participants tables to complete. The remaining questions (3-11) gave them questions to answer. A number of questions 3-11 were not answered by all the participants, perhaps because the questions required more effort and time to complete than a chart. Consequently, fewer questions of this kind were included in the final survey (Phase VI). The rationale for the modified survey was to create the conditions in which quantitative findings could be qualified and developed through the qualitative responses (see appendix 3 for the second survey).

5.2.5 Data analysis

The analytical method underpinning Phase II was to probe the extent to which technology use was dispersed across a wide range of technologies, or concentrated in a small number.

More specifically, the analysis of the data collated the numbers of participants who were aware of and/or used various technologies. This enabled a perception of the extent to which participants relied on established technologies, or were engaging with emerging, potentially disruptive technologies. The data were analysed in specific relation to Disruptive Innovation by noting the purposes for which participants used technologies.

The data were also analysed to try and identify potential contradictions between nodes in a second generation activity system, for example the potential contradiction between subject, tools and objects when a wide range of technology tools are available, creating a potential problem for the subject, who may be unsure what tool to select. This approach to analysis was adopted because there were two theoretical frameworks to be taken to account for the survey, and the aim was to draw out different facets of the data to illustrate each theoretical approach.

5.2.6 Findings

In common with the pilot study survey, it became clear that well-established technologies were well known and used, whereas newer, more obviously potentially disruptive technologies tended not to have been heard of by the participants. Tables 6.1 and 6.2 below show responses to two, specific and related questions from Phase II.

Table 5.1 Responses to question 1, "... please indicate, by ticking 'yes' or 'no', whether you have heard of the technologies listed. If you have heard of the technology and have also used it, please put a tick in the third column."

	Yes	No	Have used
Bebo	13	7	2
Delicious	4	16	1
Dictionary.com	12	8	7
Elluminate	5	15	2
Facebook	20	0	15
Flickr	17	3	3
LinkedIn	18	2	10
MySpace	19	1	5
Prezi	4	16	0
Second Life	11	9	2
Skype	19	1	12
Survey Monkey	9	11	6
Twitter	20	0	6
Wallwisher	1	19	1
Wikipedia	20	0	18
Wordle	2	18	1
Xtranormal	0	20	0
You Tube	20	0	16

Table 5.2 Responses to question 2,

“... please indicate how you have used the technologies. Feel free to tick more than one box for each technology, if applicable. If it is a technology you have not used, please leave that row blank. By ‘formal learning’ I mean learning in the context of a course at a Higher Education Institution (HEI). By informal learning I mean learning not related to a course at an HEI.”

	Work	Recreation	Formal Learning	Informal Learning
Bebo		2		
Delicious	1		1	
Dictionary.com	2	6	4	7
Illuminate	1		2	
Facebook	3	14		2
Flickr		3		
LinkedIn	5	4		4
Moodle	5		4	2
MySpace		5		
Prezi				
Second Life	1		1	1
Skype	4	11	1	2
Survey Monkey	5		3	1
Twitter	2	3		1
Wallwisher				
Wikipedia	10	14	9	17
Wordle	1			
Xtranormal				
You Tube	9	15	5	12

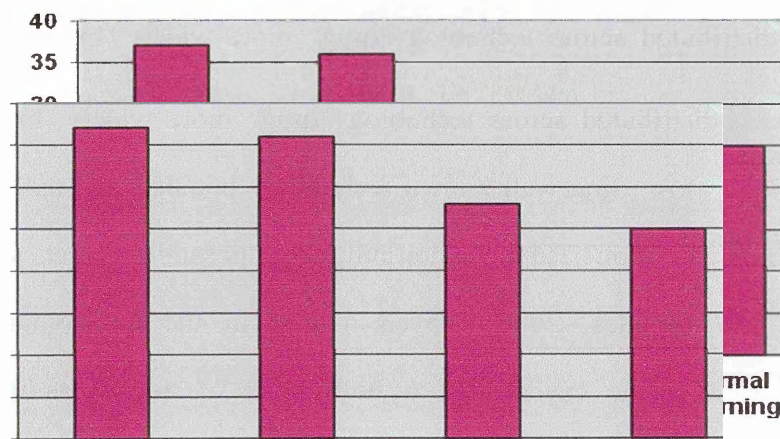
The responses to the two questions, illustrated in the above tables, showed high awareness of established technologies (You Tube, Wikipedia, Twitter, Facebook, Skype), but low awareness of more emerging technologies (Wallwisher, Xtranormal), in common with the pilot study survey. Prezi and Xtranormal were not used by any of the sample. One participant stated that they had used Wallwisher, but did not declare the purpose for which they had used it. The survey questions further showed that Wikipedia, You Tube and Facebook were the technologies used by most of the sample. In addition, the answers to the questions showed that technologies tended to be used for one purpose in general (e.g, Facebook being used for recreation), but Wikipedia and You Tube were more multi-purpose in their usage, perhaps comprising hubs from which a range of other resources, including knowledge resources, can be accessed.

Most of the technologies that were known by nearly all of the participants had also been used by the participants. The exceptions were MySpace which, as discussed earlier (Robards, 2012), is less popular than formerly since the emergence of Facebook. The reasons behind why Twitter had not been used by most of the participants, despite having been heard of by the whole sample, are not clear. Markides's (2006) argument concerning the marketing of disruptive technologies may be useful in this regard, with successful marketing resulting in a high level of awareness of Twitter. However, Markides does not analyse the apparent lack of correlation

between high levels of awareness and high levels of usage, which this, Phase II survey suggested.

Considering a technology that featured in both surveys (and thereby working from a larger data set for a specific technology), seventeen out of the twenty respondents to the second survey used Wikipedia for informal learning, fifteen for recreation, twelve for work and ten for formal learning. Combining the two surveys, and out of a sample size of forty eight, twenty eight used Wikipedia for work, thirty six for recreation, twenty five for formal learning, and thirty seven for informal learning, as shown in bar graph form in the table below.

Table 5.3 Purposes of Wikipedia use aggregated across sample size of 48



The table indicates the widespread use of Wikipedia by the combined sample, suggesting it can function as a hub technology as well as a disruptive technology, being free, convenient, simple and easy to use (Christensen, 1997) and being a central source, a hub, from which a range of

information can be accessed. Even in the category with the lowest score (formal learning), over half the combined sample was using Wikipedia.

More broadly, the findings for the second survey largely reproduced the findings of the first survey, in the sense that it suggested participants shape their own purposes for technologies, in line with Christensen and Raynor (2003). Furthermore, the survey findings also suggested individual technologies can undertake a wide range of tasks given, for example, the widespread and varied use of Wikipedia. However, participants in both surveys seemed to rely on a few technologies for a wide range of purposes, contributing to the analysis of the overall research question by suggesting demarcation in the use of technologies, as Timmis (2012) also suggests. Disruptive use seemed to be concentrated in a small hub of technologies, rather than distributed across technology usage more widely. In addition, participants were using well known technology brands, such as Facebook, Wikipedia and You Tube, underlining the possibility that successful marketing (Markides, 2006) played a part in the technologies used, notwithstanding the caveat that a high level of awareness might not necessarily equate with a high level of usage.

From a second generation activity system perspective, the survey also examined how subjects were using the plethora of technologies available, thereby managing the tools node within an activity system. One participant stated, "Adding too many technologies to support teaching/learning, especially where one or two can do the job, can overwhelm the student (and

the educator!)” Participants tended to opt for technologies that coincided with Christensen’s criteria (1997, p.xv). In activity system terms, a contradiction between the subject (participant) and tools (plethora of available technologies) is resolved by the subject, through the use of technologies that are simple, easy to use, convenient and (ideally) free, thereby incorporating the two, core theoretical frameworks for this research.

Analysis of the second surveys also suggested that awareness of some technologies that can be used to support learning and teaching is slight. Nineteen of the sample had not heard of Xtranormal, seventeen had not heard of Wordle (software providing visual reworkings of texts) or Wallwisher, and fifteen had not heard of Delicious or Prezi. There was thus a contradiction between the subject and the tools node of an activity system, with awareness of technologies not correlating with the wide range of technologies available. This may suggest that users can achieve tasks with a small range of technologies, or that the volume of technologies potentially available does not necessarily enhance learning and can, instead, be overwhelming.

That said, the analysis also showed some technologies being used for more than one purpose. Eleven participants used Skype for recreation, but five also used it for work, two used it for informal learning, and one (a research student) for formal learning. Similarly, sixteen participants used You Tube for recreation, while twelve used it for informal learning, nine for work, and five for formal learning (neither Skype nor You Tube featured in the

original, pilot study survey). Participants were therefore capable of forming multiple purposes for technologies. None of these are explicitly technologies for learning, and none are supplied directly by HEIs, but a number of HEIs have You Tube channels, which may suggest that HEIs are responding to technologies that prove popular in practice, providing explicitly educational subject matter for the medium of delivery. In second generation activity system terms, a potential contradiction between a tool (You Tube) and the social nodes on the bottom tier of the activity system is resolved by the HEI locating some learning materials in the tool, thereby accommodating use of aspects of the tool within the HEI. Moreover, the emergence of You Tube as a platform for delivering explicitly educational context may reflect Christensen's (1997) and Christensen and Raynor's (2003) analysis of how disruptive technologies take hold, as an initial, disruptive practice is then enhanced along sustaining technology lines, achieving market growth. From this perspective, while almost all the technologies in this research can be divided into institutional and non-institutional, You Tube, via dedicated university channels, may be evolving into a quasi-institutional technology in this specific respect.

A feature of the first survey, which was repeated in the second, was that Second Life (a virtual world peopled by participants' online personae [avatars]) was only used by one participant. The participant in the revised survey (not the same individual from the pilot study) used Second Life in their role as a research student (again, it is noteworthy that the purpose is determined by the user, not by a designer's intentions). However, while only

one participant used Second Life, a technology with a relatively steep learning curve (the participant has to learn to move, interact, shift from one location to another, manage their online identity), almost all the participants used Wikipedia, which is conspicuously easy to use, with a prominently placed search box, and which is an encyclopaedia, a type of publication with which almost everyone is familiar. Second Life, a virtual world, is more likely to have to define itself (i.e., explain its purpose, what it does) before potential users can use it. Within an activity system framework, Wikipedia's object (in the sense of purpose) as a tool is readily evident, but the same is not true of Second Life.

Second Life may thus expose a contradiction between nodes. It is a tool, but the object may be unclear, and the rules and the community may both be opaque (Carr [2009] writes of the "relative emptiness" of Second Life, and that it is "potentially confusing"). The lack of distinctiveness in the social nodes can create confusion for the subject. In addition, the subject has to engage with the tool to resolve the contradictions which may, in turn, comprise a disincentive to engage substantially, not least as the process, as a result of the opacity of some of the nodes, is not simple and convenient.

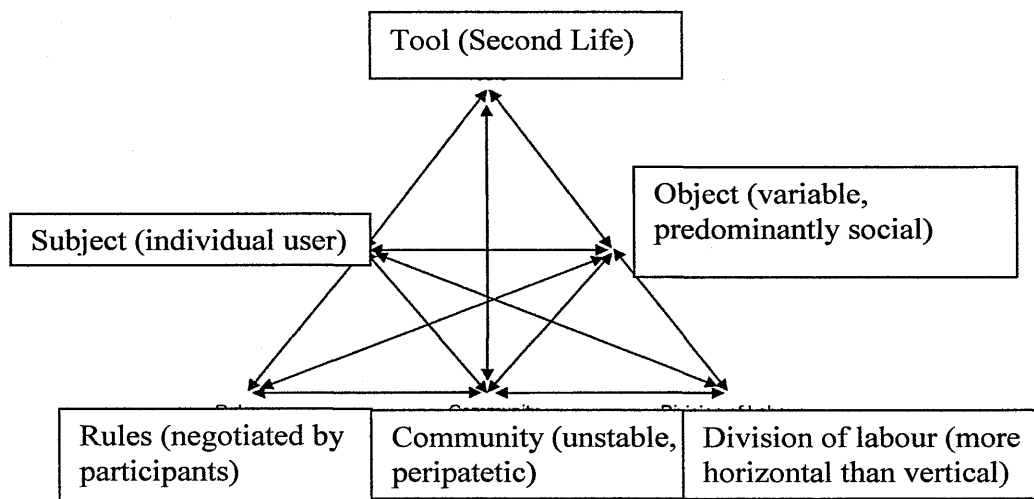


Figure 5.4 Second Life use as described by participant, constructed as activity system.

The figure above highlights how the absence of a clearly delineated object results in the social nodes being, to an extent, amorphous and thereby compromising the effectiveness of the activity system.

With the second survey having produced more data about the use of technology, the Phase I participants were re-interviewed, to produce data on how technology use may develop over time.

5.3 Study Phase III – re-interviews

5.3.1 Introduction

Following Phase II, Phase III of the research supported the research aim of considering how HEIs in the UK can engage disruptively with disruptive

technologies by examining how participants had used a technology with which they had not previously been familiar, thereby enabling a consideration of the extent to which a purpose for a technology emerges through usage, over time.

5.3.2 Study sample and context

The two participants (a lecturer and a student) who had been interviewed for Phase I were re-interviewed after a period of ten months. The purpose of the re-interviews was to see how their technology use had developed and, in particular, to see if they had found a purpose for the technology to which they had been introduced in Phase I. Both participants still held the lecturing and student roles they had held at the time of the first interview and were in a position to provide different insights on the use of technologies in learning and teaching in higher education, as they occupied different roles. Both interviews were conducted at the participant's place of work.

5.3.3 Investigation procedure

At the end of the first interview the first participant (lecturer) had been introduced to Delicious (bookmarking software) by the researcher, but not

given instruction in how to use it; the participant had confirmed that she was not familiar with the technology, and had not used it.

The second participant (postgraduate student and learning technologist) had been introduced to Wallwisher (free online notice board) by the researcher, but not given instruction in how to use it; the participant had confirmed that she was not familiar with the technology, and had not used it.

Exploring how the participants had used the technologies to which they had been introduced in their first interviews enabled, in turn, an exploration of how a purpose for a technology can emerge and develop through practice over time, thereby linking both to Christensen and Raynor's (2003) argument that disruption emerges through practice, and Engeström's argument that activity systems evolve over time (1999a, p.381).

The interviews also analysed other aspects of the participants' use of technologies to support learning and teaching, such as the lecturer's perceptions of students' use of a VLE, and the learning technologist's perception of other academic community members' use of technologies.

5.3.4 Data gathering

The interviews were semi-structured. That said, both participants were also asked specifically about the technology to which they had been introduced

at the end of the Phase I interviews, thereby introducing a more structured element to the interview, as there was an area to which the researcher wanted to pay particular attention. Focusing on the new technology to which the participant had been introduced enabled a sense of how technology use could develop over time, thereby enabling integration of both Disruptive Innovation (participants had an opportunity to develop a purpose for a technology through practice), and expansive learning, as Engeström argues tensions and contradictions in activity systems accumulate over time (Engeström, 1987, 1999a, 2001). The interviews were recorded, and subsequently transcribed. The transcriptions were referred back to the participants, to confirm that they were happy with the accuracy of the transcription.

5.3.5 Data analysis

The Phase III re-interviews of the Phase I interview participants were analysed to revisit the key and recurrent themes evident in the first interviews, relating to disruptive technology usage, and potential contradictions between subjects, tools and other nodes in an activity system.

The Phase III re-interviews were also concerned with the extent to which each participant had created a purpose for a new (to them) technology. Both interviews were coded, to identify key and recurrent themes, such as the use of disruptive technologies, the attainment of a purpose for technologies

through practice, and potential tensions between nodes in an activity system. The analysis examined how the new (to each participant) technology had been used, and whether a purpose had been created for it. In addition, the analysis considered whether the participant's use of technologies had affected other areas of their learning and teaching practice.

5.3.6 Findings

In the ten month interval since the first interview, the first participant (lecturer) had used Delicious frequently, with the use of the tool expanding to include her family, and her wider social network. The participant related her experience to the ease of use of Delicious: "I think it was a fairly rapid adoption. I wouldn't call myself somebody who was naturally proficient in technology, but it was very much an instinctive environment." Delicious conforms to Christensen's definition of a disruptive technology (1997, p.xv), because it is simple and easy to use. It is also convenient, and free. In addition, the participant's experience aligns with the revised definition of disruption offered by Christensen and Raynor (2003), as the disruption emerges through practice. That said, the participant's use of Delicious is not necessarily disruptive in one sense, as the technology itself does not declare a purpose, other than enabling the easy storage and retrieval of web links. However, the participant's behaviour is disruptive in the sense identified by Christensen and Raynor (2003), in that she has constructed a purpose for

Delicious, through usage. In second generation activity system terms, the subject used the tool to attain an object and, moreover, the subject's use of the tool affected her immediate community (family) by including them in the use of the tool.

The first participant had also, within the ten month interval between interviews, extended her LinkedIn network to over fifty people (LinkedIn was not the new technology to which the participant was introduced). Moreover, the network had continued to be social as well as professional. In addition, the participant stated that her involvement in LinkedIn was changing in some respects, and becoming more immersive: "people seem to be updating their profiles more readily... saying okay well I've come across this particular conference which is of interest to me, or this particular website, or I'm being involved in this event and consequently you are being drawn more into that community as a consequence of that." Through practice rather than design, and in accordance with Christensen and Raynor (2003), the participant was making more use of the technology, and her use of it was developing, too.

The first participant was also asked about her perceptions of her undergraduate students' uses of technologies to support learning.

They have got access to [name of HEI] virtual learning environment. Some of them have been fairly swift to embrace that. Others still have not logged-on, which is a concern as even in the induction week we showed them how to do it... So some are not as technologically proficient as we thought they would be.

Others are extremely adept. We did some presentations earlier this week; they were quite happy hyper linking to You Tube and other sites. Similarly they are quite happy to sit down and work with their own laptops or iPads and conduct research there – in fact they prefer to do that than rifle through the core text, even when you tell them that the information is there in the core text. They instinctively jump onto what they are more familiar with.

While it was not the primary purpose of the interview to investigate hypotheses concerning why the students were not all accessing the institutional VLE but making frequent use of other technologies, it is noteworthy that the students appeared to have their own preferred technologies for learning, which were not necessarily the learning technologies supplied by their HEI. In common with the observations (see Phase IV), participants selected a technology tool for specific jobs, a practice also noted by Conole *et al.* (2008). Moreover, while the participant's view is that some of the students are not technically proficient, it may, alternatively, be the case that students are choosing which technologies they use to support their learning. A potential contradiction between subjects and tools is managed effectively by students, identifying an object and selecting a convenient, easy to use, simple and free tool to accomplish the object.

The second participant outlined a frustration she experienced as a learning technologist: "I also get a lot of – 'we need an app' – which I find irritating because we don't need an app. I do get a lot of, what's this, we should be using it, from staff, without a clear idea of what we should be using it for."

The participant's frustration appeared to arise from the absence of a specific job for the technology to do. The absence of an object, in activity system terms, hampers the use of a tool, which has no clear purpose. An object is a prerequisite for an activity system, though the interactions of subjects, tools and the social nodes of a second generation activity system have the potential to change the object (Engeström, 1999a).

Furthermore, the second participant had not continued to use Wallwisher (the technology to which she had been introduced), stating, "like with all of these things, unless everyone else is using it, it doesn't perhaps fulfil its potential." The participant was unable to construct a personal meaning for the technology, which thus remained unused. Moreover, the participant was put off by the fact that other people were not using the technology. Christensen *et al.* (2008) claim that disruptive technologies building a coterie of users from non-users of a similar or related product, and, in this instance, the absence of a community of users prohibits the adoption of the technology.

The interview with the second participant suggested that the capacity for a technology to undertake a range of tasks may be related to its take-up, or otherwise, by users. From an activity system perspective, the subjects (participants in this phase of the research) had different tools. One of the subjects was able to create a purpose for the technology tool, and one was not. The purpose (object) of the technology does not have an independent existence, but is produced by the interaction of subject and tool, an anti-

technological determinism position implicit in the second generation activity system and also presented by Grint and Woolgar (1997).

5.4 Conclusion

Reviewing the first three, post-pilot study phases of the research, some general suggestions and ideas arose. For example, some form of critical mass may be important for the adoption of a technology; Christensen *et al.* (2008) argue that disruptive technologies commonly take root among non-consumers of a similar or related technology. A network of users, rather than dispersed individuals, may be necessary for a technology's expansion. However, marketing can also enable or prompt disruption, as it can create a community of users for a technology, and thus innovation, or disruption, in the use of technologies to support learning can be manufactured, as suggested by Markides (2006).

A further idea to emerge from the first three phases of the research is that academic community members may be attracted to hub technologies, meaning technologies conforming to Christensen's core criteria (1997, p.xv), but also having multi-functionality. Wallwisher is simple, easy to use, convenient and free, but it may also be a limited tool, and thus distinct from Google, Wikipedia and Delicious, which are more obviously multi-

functional, as well as enabling easy linking through to other resources. The capacity for a technology to undertake a range of tasks may therefore be related to its take-up, or otherwise, by users. From an activity system perspective, the subjects (interviewees in two phases of this research) had different tools. One of the subjects was able to attain an object for the technology tool, and one was not. Having an object was a prerequisite for the successful use of the technology.

If some form of critical mass is important for the adoption of a technology, then marketing is relevant, as it can create a community of users. If disruption does not occur in an unfettered sense but is, instead, shaped by economic and social factors, then it may be possible to create disruption consciously through the creative manipulation of economic and social factors (see Markides's [2006] critique of disruption). Christensen's definition of disruption may therefore need to be further refined to recognise the constraints within which disruption operates. Smagorinsky (2001) argues that meaning is constructed in contexts determined historically, politically and economically, an argument underlined by Vygotsky (1930/1998) who sees subjectivity as determined. Users do not approach tools as a limitless index of possibilities. Viewed from a second generation activity system perspective, there is a contradiction between the subject (academic community members) and the tool (technology) because rules, both explicit (e.g., assessment-driven higher education systems) and tacit (the limitations on usage created by history, or current practice), may seek to impose limits on what can be done with technologies, the community

may not be willing to accept a new use for a tool, and the division of labour in society may determine who has access to a particular technology. In the context of this research, participants have preferred technology brands, evident most explicitly in the observations (Phase IV, chapter 6). The use of tools is thus shaped by factors external to the learning and teaching situation. Furthermore, some tools may be deemed inadmissible by an HEI.

It may be that technology use can start effectively from the identification of a job to be done, and then selecting a technology tool to undertake the job. The absence of a clear object for the technology creates a contradiction, as it prohibits the construction of an effective role for the technology tool. More broadly, the frustration exhibited by the second participant in Phase III stems from an approach which places technology before practice (also noted by Cuban, 2001, pp.99-101). Conversely, the approach of this research is to analyse practice (human activity) first.

A further point to emerge from the first three phases of the research is that the purpose (object) of the technology does not have an independent existence, but is produced by the interaction of subject and tool, an anti-technological determinism position also presented by Grint and Woolgar (1997). Technologies, this research argues, are essentially inert, acquiring purpose from human practice rather than their design features but, once activated, being able to repurpose other aspects of an activity system, just as tools are repurposed.

More broadly, the first three, post pilot study phases of the research suggested that learners and teachers do not appear to desire or need a wide range of technologies. Instead, they used a small range of technologies to achieve a wide range of tasks. A large number of tools are available, but having a large number of technologies available to support learning and teaching does not enhance learning and teaching axiomatically. Instead, having a large number of tools can create a contradiction, with the object of successful learning experiences being potentially compromised by the amount of technologies available. A further contradiction may emerge between subjects and tools, as the plethora of technologies available can impede rather than enhance students' learning. Participants selecting a small number of technologies may be an appropriate tactic on the part of subjects to manage the contradictions. The self-selection of technologies does not signify laziness, but, instead, the efficient use of resources to achieve an end. Consequently, the use of a narrow range of technologies to support learning and teaching can be viewed positively as an example of expansive learning; technology use gets concentrated in a hub of technologies (generally non-institutional), from which a range of possibilities are available. A contradiction between tools and an object is resolved by the judicious selection of tools by subjects, on criteria complying with Christensen's definition of disruptive technologies. A new activity system may thus emerge, characterised by the use of non-institutional tools, and a more horizontal division of labour.

The next chapter develops the research by observing technology use in practice (thereby witnessing how technologies are used), conducting further interviews, and by issuing a final survey to a wider sample.

CHAPTER 6: MAIN STUDY – PHASES IV, V and VI

6.1 Introduction

The previous chapter used interviews and a survey to identify the technologies participants were using to support learning and teaching. The chapter also examined how participants gained competence in technologies and constructed purposes for technologies. The chapter argued that purposes arose from practice rather than design, in line with the definition of Disruptive Innovation presented by Christensen and Raynor (2003).

This chapter constitutes the main study and examines the last three phases of the research, which comprised structured observations, structured interviews and a final survey. This chapter reviews each of these research iterations in turn. The chapter argues that academic community members demarcate in their uses of technologies, using a small number of tools (generally non-institutional) to accomplish a wide range of tasks, and constructing purposes for tools through their usage of them.

6.2 Study Phase IV – observations

A distinctive feature of this chapter is that it investigates actual practice with technologies to support learning and teaching, through observations. These involved the researcher watching the participants undertake a given task

involving the use of technologies to support learning and teaching, in order to see if they used disruptive technologies and, more broadly, to see how they used technologies to support their learning and teaching.

6.2.1 Study sample and context

Four students and three lecturers participated in the study, having been invited to do so by the researcher. A further lecturer had been approached, in order to get an equal number of lecturers and students, but was unavailable on the day scheduled for observation, and it was not possible to arrange an alternative date within the time allotted for observations. Equivalent numbers of lecturers and students had been sought to see if there was a discernible difference in technology use between the two constituencies, and none was detected.

6.2.2 Investigation procedure

The student participants were given the following task:

You have been asked to write an essay for assessment at a Higher Education Institution, concerning the issue of widening participation in Higher Education. Identify, gather and store relevant information for this essay, using only the computer in front of you. Do this for fifteen minutes.

The lecturer participants were given the following task:

You have been asked to prepare a class on emergent forms of assessment in Higher Education. Identify, gather and store learning and teaching materials for this purpose, using only the computer in front of you. Do this for fifteen minutes.

Observations were conducted because they enabled examination of actual, *in situ* practices with technologies to be recorded (Cohen *et al.*, 2000, p.305), and also enabled potentially disruptive uses of technologies to be identified. In addition, and incorporating a second generation activity system perspective, observations produced data which enabled examination of how the division of labour in higher education may be changing, with participants not mediating their acquisition of knowledge resources through an HEI, but constructing knowledge more directly through their own interactions with technology tools. A possibility for expansive learning thus emerges, as an existing activity system is modified through the practices of subjects (academic community members) with tools (disruptive technologies) impacting on the division of labour (knowledge resources being accessed through means other than the HEI). More broadly, observations allowed researchers “to observe ongoing behaviour as it occurs and are able to make appropriate notes about its salient features” (Cohen *et al.* 2000, pp.187-8; see also, Bailey, 1978). The observations thus enabled the collection of data distinct from the surveys and interviews, though the observations were not fully ethnographic, as they involved the researcher

giving the participant a structured task, rather than observing the participant in their day to day interactions.

The observations had the potential to expose contradictions between declared and actual practices, the former featuring in surveys and interviews (see chapter 5). The importance of observing what learners actually do with technologies is noted by Timmis (2012, p.6). Moreover, Christensen *et al.* (2001) argued there is a difference between what students say they want, and what they actually do with technologies to support learning. Relating the observations to the theoretical frameworks, the observations allowed the disruptive use of technologies to be recorded, and also allowed observation of the interactions between subjects, tools and objects, with possible implications for the division of labour in higher education, and for the higher education community.

6.2.3 Data gathering

The observations involved the researcher sitting in a room with each participant. Meeting rooms and classrooms were booked for the purpose. The researcher's own office space was eschewed, and all the computers used were on the HEI's network. All the participants were frequent users of the network. It is recognised that the researcher's presence may have had some effect on the observation, a phenomenon noted by Cohen *et al.* (2000, p.316) and Bryman (2004, pp.175, 179). To ensure appropriate ethical

practice, each participant was reminded of key information about the research before the observation took place, and each participant was informed that they could stop the observation at any time, without giving a reason.

The observation data (researcher's notes) were compiled by recording the participants' practices by hand, taking contemporaneous notes minute by minute. The notes were subsequently transcribed, and offered back to the participants to ensure they were happy with the accuracy of the transcript. An example of a specific observation is included in the appendices (Appendix 4).

6.2.4 Data analysis

The intention of the observations was to foreground the participants' actual, physical practice, recording what they did as they did it. The data were analysed, primarily, to identify the participants' preferred method for gathering and storing information to support learning and teaching. This focus created the conditions in which potentially disruptive practice could be observed with, for example, participants using non-institutional technologies to support their learning and teaching. The observations showed that each participant had a method, which they reproduced over the course of the observation, changing search terms on Google but not changing their method. The observations were also analysed in relation to

Disruptive Innovation (Christensen and Raynor, 2003), considering if purpose arose from usage. In addition, the data were analysed in relation to the second generation activity system (Engeström, 1987), considering if technology use had implications for social relations in higher education, including the division of labour.

6.2.5 Findings

The observations data showed participants using a narrow range of technologies (Margaryan *et al.* [2011] came to the same conclusion, based on interviews with eight students). The most common approach, adopted by five of the Phase IV participants, involved most of the research being done via Google, with results (text or urls) saved to a blank Word document and saved in 'My Documents'. Four of the participants used an academic journal aggregator made available by their HEI, but one of those four went to the journal aggregator after having undertaken their initial search on Google. Only one participant used Delicious to store and tag web links; five copied links to a blank Word document, and one emailed links to herself, via a facility on the academic journal aggregator.

Participants did not look beyond the first two pages of results obtained on Google, and five participants did not go beyond page 1 of results on either Google or Google Scholar. The observations thus suggested users wanted and expected quick results, and valued ease of access (in line with

Christensen's argument [1997]), though the participants' actions may also have been shaped by the short time allowed for the tasks.

Three of the participants used Google Scholar. Six of the seven used Google. Some individual practices included one participant entering search terms in a search box on her HEI's home page. The results came up provided by Bing. The participant clicked off Bing instantly without looking at the results, and repeated the same search on Google. It appeared the participant had a preferred brand, and wasn't interested in trying another. Seeing technology in terms of brand choices links with the critique of Disruptive Innovation offered by Markides (2006), who sees innovations and disruptions in technologies being shaped more by effective marketing than by spontaneous creativity.

The small range of technologies being used to support learning and teaching also suggested that a contradiction between subjects (individual participants) and tools is resolved by subjects by selecting simple, convenient, easy to use and free technologies, thereby bringing together Engeström's activity system (1987), and Christensen's definition of disruptive technologies (1997, p.xv).

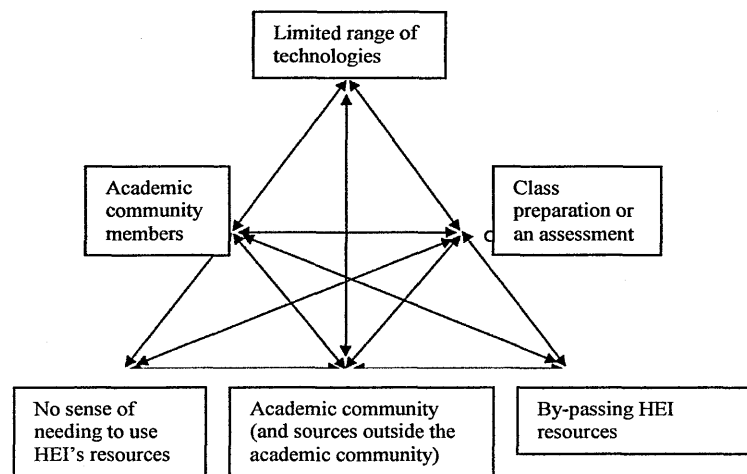


Figure 6.1 The observations as an activity system.

While the observations showed participants using a narrow range of technologies, all the participants were able to undertake the task. The technologies selected were able to perform the job, and consequently participants did not use other technologies. The participants seemed primarily concerned with getting the job done by simple and convenient means.

The observations as a whole suggested technologies were being used flexibly, and disruptively, because the user creates a purpose for the technology, but there was no evidence in the observations to suggest that a wide range of technologies were being used to support learning and teaching. Conversely, there was evidence of expansive learning (Engeström, 1987), as a contradiction between the tools (available range of technologies) and object (purposes for which individual technologies are applied) nodes of

a second generation activity system was resolved by participants through the use of a small number of technology tools, enabling learning and teaching tasks to be accomplished.

Data from the observations also showed technology, as a tool, impacting on other nodes within the activity system. In particular, the social nodes in Engeström's activity system triangle (rules, community and division of labour) are affected by the way technologies are being used to support learning and teaching. Learners are less reliant on reading lists supplied by lecturers, and can easily use other sources to support their learning. Therefore, the role of the HEI as gatekeeper to knowledge is challenged, as material can be accessed any time and from anywhere, using a networked device. The idea of the lecturer as the primary source of knowledge is also effected, and thus the existing division of labour in higher education is impacted upon.

It is acknowledged that the design of the observational study, and in particular the fifteen minute time limit, may have propelled participants into using Google rather than more explicitly participatory technologies on which a question could have been posed to other users and an answer invited. Moreover, the study did not propel participants towards an institutional VLE. That said, the study did allow for the possibility of the use of an academic journal aggregator, yet the participants tended to use Google in preference to an academic journal aggregator, and Google has

more of the features of a disruptive technology than does an academic journal aggregator.

Following the observations, a small number of structured interviews were undertaken, to revisit the area of how participants learned to use, and formed purposes for, technologies. These interviews are summarised in the next section of the chapter.

6.3.1 Study Phase V – Structured interviews

In order to further investigate how HEIs can engage constructively with disruptive technologies, structured interviews were conducted to provide specific data on how competence with technologies was gained, and purposes for technologies achieved. The structured interviews focused on understanding how different academic community members gained competence with technologies and achieved a purpose for technologies. The interviews also traced demarcation of technology use, thus building upon earlier research findings. The interviews further explored reasons behind individuals' technology choices.

6.3.2 Study sample and context

Three structured interviews were conducted, with participants who had completed the second survey, and/or had participated in the observations. The participants were invited by the researcher, by email, after having declared an interest in the research, and declaring a willingness to participate further. The participants comprised a lecturer, a postgraduate student, and an undergraduate student, thereby gaining perspectives from different roles within an academic community.

6.3.3 Investigation procedure

Structured interviews were undertaken in order to record participants' responses to specific questions related to the purposes for which technologies are used. Two of the interviews were undertaken face-to-face at the researcher's place of work, in an office booked for the purpose (i.e., not the researcher's own office); the third was undertaken by telephone. The questions explored ideas around disruption, as Christensen and Raynor (2003) modified the position presented originally by Christensen (1997) by arguing that disruption is not a design feature of a technology but, instead, emerges through practice. The questions related to disruptive technology and Disruptive Innovation by exploring the sources participants used to access and build knowledge. The questions related to expansive learning by considering the purposes (objects) for which technologies are used.

Moreover, the questions relating to the purposes for which participants used technologies were asked because the initial surveys had suggested participants use technologies for more than one purpose, while the observations had suggested (perhaps because of the short nature of the observation) that a narrow range of technologies are used to support information gathering and storage as an aspect of learning and teaching in higher education. In addition, looking at participants' purposes regarding technology use related to the core research question and Christensen and Raynor's analysis (2003), by identifying potentially disruptive usage.

Structured interviews were also undertaken to explore further the technologies participants used to support learning and teaching, and to explore how the participants gained competence in technologies. The interviews thus considered the extent to which participants' experiences with technologies could be described as disruptive, by considering whether they preferred institutional or non-institutional technologies to support their learning and teaching.

6.3.4 Data gathering

The interviews were recorded by hand contemporaneously by the researcher, and subsequently transcribed. The transcripts were subsequently referred back to the participants, to ensure they were happy with them. The

same questions were put to all three participants, in the same order. A sample interview is included in the appendices (Appendix 5).

6.3.5 Data analysis

The interviews were coded, identifying key themes, such as the use of sustaining and disruptive technologies, and participants demarcating their uses of technologies (as had been implied in the observations, with a narrow range for technologies being used to support learning and teaching). The data were analysed primarily to identify disruptions and contradictions, primarily between tools (technologies) and rules (implicit norms shaped by the design and marketing of technologies). More precisely, the analysis looked for instances when a purpose for a technology had been created through usage. The analysis also sought to identify broad contradictions between tools and the social nodes in a second generation activity system. The coding of the interviews reflected these core intentions. The data were also analysed to examine if the different roles of undergraduate student, postgraduate student and lecturer produced similar or different results.

6.3.6 Findings

The interview findings indicated significant demarcation in technology use, and reproduced previous findings in the research by showing that the

participants were self-taught in their use of technologies, establishing purpose through usage. The findings did not suggest that different roles viewed technologies in fundamentally different ways.

All three participants stated that they demarcated their use of technologies, using different technologies for learning and teaching than for socialising, notwithstanding the potential of the technologies used for socialising to support learning and teaching. This goes against the earlier survey findings, which suggested that participants do use technologies for more than one purpose. The contradiction is between subjects (participants) and tools (technology); subjects prove resourceful, managing the contradiction through self-selection and demarcation, pursuing different objects (educational on the one hand, and social on the other) through different technologies (Timmis [2012, p.9], also notes users demarcating their uses of technologies).

More broadly, and as the research evolved through different research instruments, demarcation became increasingly apparent. Despite the plethora of technologies available, participants were using a small number to undertake a wide range of jobs. Furthermore, the technologies that were chosen tended to conform to Christensen's core criteria (1997, p.xv).

All three participants described themselves as being overwhelmingly self taught with regard to technologies: comments ranged from "80-90% self taught," to "pretty much self taught," to "very self taught." They were

therefore well placed to have established purposes for technologies through usage, rather than in keeping with a designer's intentions and thus in line with Christensen and Raynor (2003). The participants' responses were also able to be accommodated within an activity system, because, as subjects, the participants were interacting with tools to achieve objects, the purposes arising through practice.

The lecturer stated that her students relied on Google for finding learning materials, and rarely used an academic journal aggregator. One of the students interviewed stated that she used Google and Google Scholar to support her set texts. The lecturer also stated that she preferred Google Scholar to her HEI's academic journal aggregator, stating, "I don't find it as user-friendly as I find Google." The interviews supported the idea that the HEI is no longer the gatekeeper to knowledge resources, as the participants go to Google, rather than to their HEIs' journal aggregators. The lecturer indicated that ease of use was a factor in why she opted for Google. Google, therefore, is a disruptive technology in the sense that its convenience and ease of use gives it an advantage over an HEI's own resources; Google is often the first page users experience, while accessing an HEI's academic journal aggregator requires logging-on, and more tasks before results are available. Google, in this context, and from a second generation activity system perspective, also affects the academic community and the division of labour within it, by providing an alternative route to knowledge, and implicitly challenging the HEI's custodianship of knowledge.

Google has a simple interface and one search box. It is simple, convenient, and easy to use (Christensen, 1997, p.xv). Conversely, Academic Search Complete has a range of fields in which to enter search terms. For example, and in order to reach the Academic Search Complete interface, the researcher had to log on to an HEI's home page with a user name and password, and then go through "people and places," "[name of HEI] Library," "Library Resources" and "Databases," before being able to access the Academic Search Complete interface (activity undertaken on 20/10/13).

Having reiterated some core ideas in the structured interviews, relating to how purposes for technologies are achieved, and the criteria by which technologies are most likely to be used, a final survey was issued to a wider sample to produce final data relevant to the research question, as discussed below.

6.4.1 Phase VI – final survey

The final phase of the research comprised a survey, developed from previous iterations of the research, supporting the overall research aim by seeking to further clarify and identify technologies which were, in practice, used to support learning and teaching. By these means the final survey sought to further understand how HEIs can engage constructively with disruptive technologies.

6.4.2 Study sample and context

Sixty-seven participants were recruited. Participants were invited by email, and by postings on module forums, with the Module Leader's consent, for modules taught by the researcher. In addition, an invitation to academic community members to participate was published in the researcher's blog (<http://idcharred.wordpress.com>), following clearance from the first supervisor. The survey responses showed that 29 participants were lecturers, 29 were students, and the remaining 9 worked in academic support or learning technology roles. Regarding this final group, its small size and its heterogeneity influenced the reliability of findings concerning this group and hence, when comparisons are drawn in this section (and Mann Whitney U tests undertaken), they are drawn and undertaken between the practices of lecturers and students. More broadly, demographic variables such as age, gender and academic discipline were not recorded in this survey.

6.4.3 Investigation procedure

The questions sought further data on how specific technologies identified in previous phases of the research were used.

The composition of the final survey was shaped by the results of the previous surveys, interviews and observations. Consequently, there was an

interest in differences in participants' practice with both institutional and non-institutional technologies.

The questions asked related to disruptive technology and Disruptive Innovation by considering whether non-institutional technologies are used to support learning and teaching. Considering the use of non-institutional technologies also relates to expansive learning because it implies participants are modifying the traditional division of labour by not routing their search for knowledge resources through technologies supplied by their HEI.

6.4.4 Data gathering

The survey was compiled and issued via the Bristol Online Surveys (BOS) system (<http://www.survey.bris.ac.uk>). The web link for the survey was made available to the participants, via emails and via the researcher's blog. The results were collated on the BOS system, and bar graphs were subsequently compiled by the researcher, based on the data stored on BOS. The user name and password for the survey was not available to anyone other than the researcher.

The first screen on the survey read as follows:

I confirm that I have read and understand the data protection statement.

I understand that my participation is voluntary and

that I am free to withdraw at any time, without giving reason.

I understand that my responses will be kept anonymous.

I agree to take part in the above study (please write your name or 'Yes' in the box).

The use of a Likert scale (Likert, 1932) for questions enabled both quick and easy responses on the part of participants, while also allowing for some differentiation of response. When Likert scales were used, the categories to record the declared usage of non-institutional technologies were as follows: frequently, sometimes, rarely, and never. However, in the case of institutional technologies the following categories were used: every day, most days, sometimes, rarely, and never. This distinction can limit the extent to which the use of the two different technology types may be compared. However, the distinction itself comprises an attempt to recognise and accommodate the more fluid nature of practice with non-institutional technologies, in the sense that the use of such technologies, which are also commonly used for social as well as learning and teaching practices, is more woven into the quotidian. Consequently, the demarcation between learning and teaching practices on the one hand, and social practices on the other, may not be explicit to the user of non-institutional technologies as, for example, the first surveys for this research demonstrated the notable use of Wikipedia to support informal learning. Conversely, institutional technologies are more likely to be used to support learning and teaching only. Asking participants to state the extent to which they used institutional technologies on a daily basis is an effective means of recording their usage

(a method which would be less applicable to the more fluid use of non-institutional technologies). It would, conceivably, have been possible to ask participants to state if they used a non-institutional technology every day, thereby having the same categories for both technology types, but as that could also have meant one usage per day (whereas another technology could have been used not daily but more frequently), it would not necessarily have been an effective means of illuminating more general usage and technology adoption.

6.4.5 Data analysis

The data was related back to the core theoretical frameworks (placed in theory driven categories such as preferring technologies that conform to Christensen's [1997] core criteria), in order to identify disruptive usage and to explore the impact of technologies (tools in activity system terms) on other nodes in a second generation activity system. Instances of disruptive technology use were sought, as was evidence that disruptive technology use was impacting on the academic community. The graphs were analysed to identify patterns of usage, thereby enhancing awareness of the technologies that were used most widely, while also clarifying what technologies were being used for. The use of graphs and the use of a Likert scale for individual questions also allowed for comparisons of questions, as shown in the findings. In addition, the use of a Mann-Whitney U test allowed the

significance of any difference in response between lecturers and students to be identified and analysed.

6.4.6 Findings

The findings suggested that participants do not use social networking technologies to support learning and teaching. The findings also showed participants making extensive use of non-institutional technologies (Google and Wikipedia) to support learning and teaching. The findings also indicated that participants made at least some use of institutional VLEs, but far less use of academic libraries. Overall, the survey suggested that participants' means of accessing knowledge resources to support their learning and teaching were weighted towards non-institutional sources.

All the participants used Google to support their learning and/or teaching (see figure 6.2).

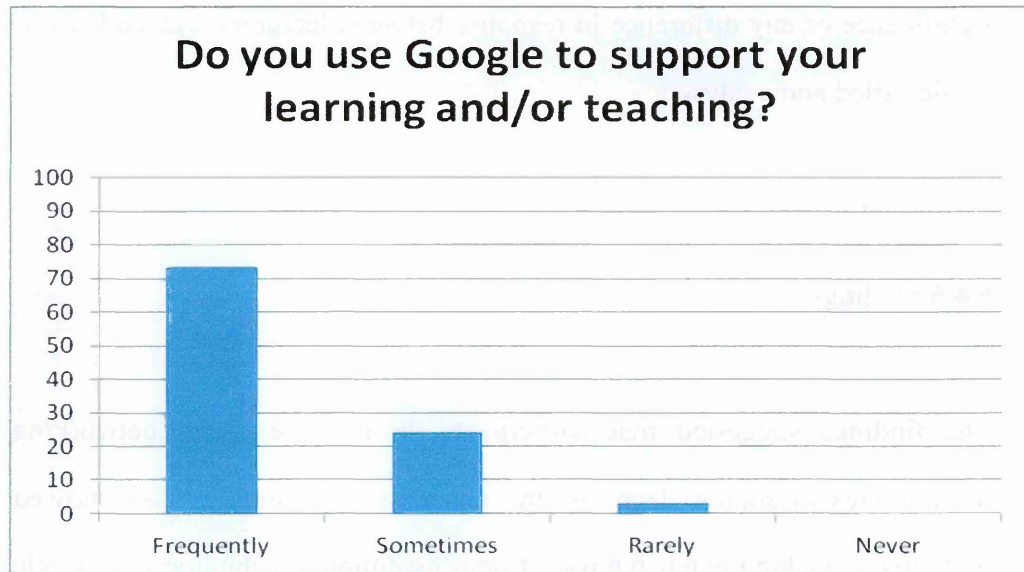


Figure 6.2 Do you use Google to support your learning and/or teaching?

Forty-nine participants used Google frequently (73.1%), 16 (23.9%) used it sometimes, and 2 (3%) rarely. When the results were broken down into the three sub-categories of lecturers, students and others the distribution of results was similar. Hence, 19 lecturers (figure 6.3) used Google frequently, 8 used it sometimes and 2 used it rarely. With regard to the student respondents (figure 6.4), 23 used Google frequently and 6 used it sometimes; for the others (figure 6.5), 7 used it frequently, 2 sometimes. The figure for student use of Google is somewhat higher than for lecturers, indicating perhaps the role and volume of assessment in taught programmes, and thus the ongoing practice of students in using Google to support their learning. A Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of Google ($U = 356.5$; $z = -1.278$; $p = .201$).

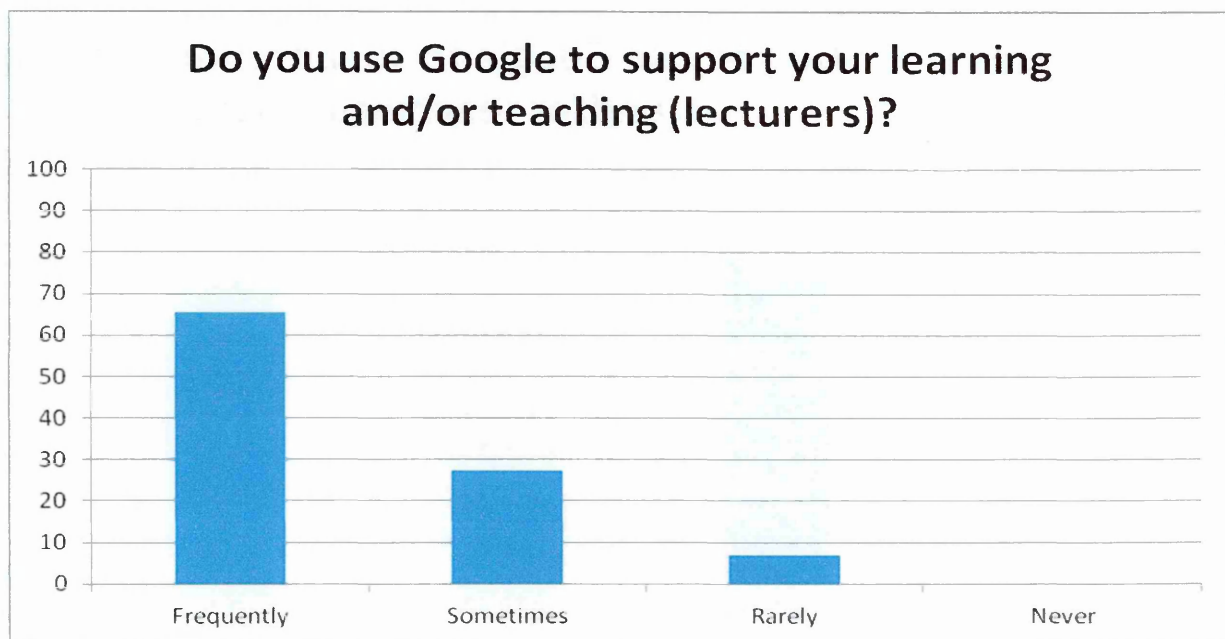


Figure 6.3 Do you use Google to support your learning and/or teaching (lecturers)?

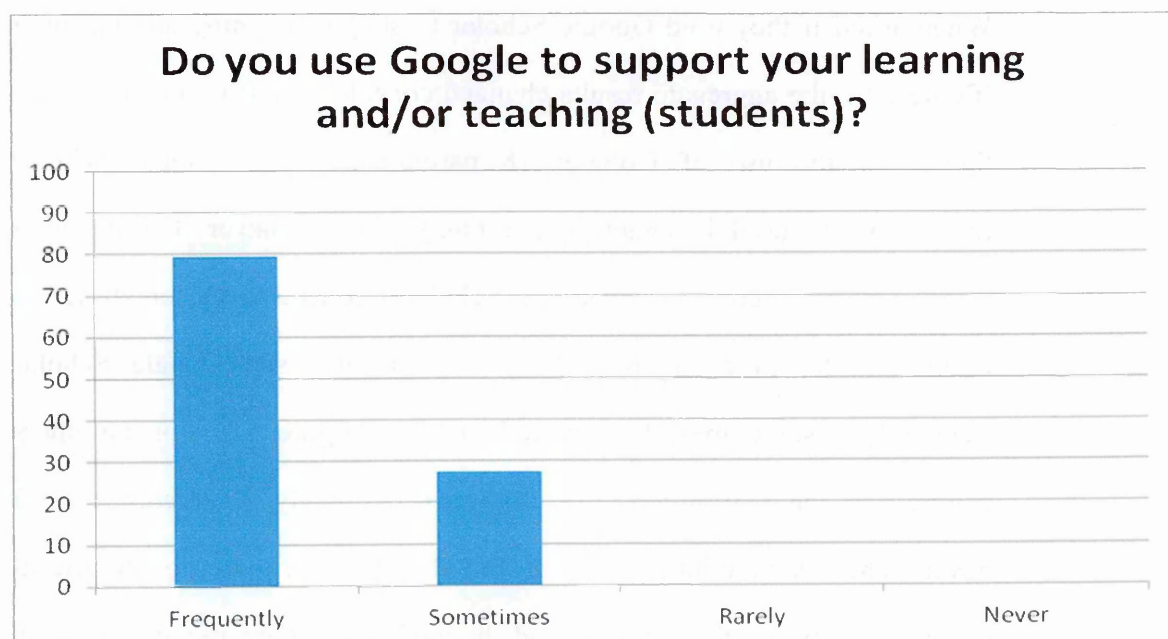


Figure 6.4 Do you use Google to support your learning and/or teaching (students)?

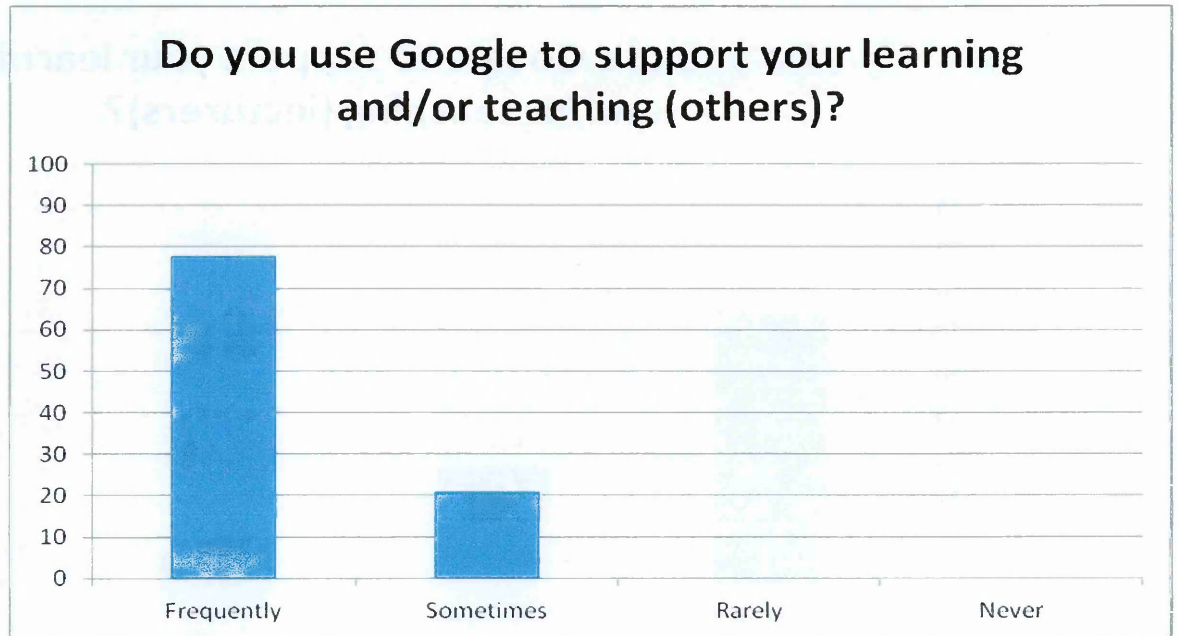


Figure 6.5 Do you use Google to support your learning and/or teaching (others)?

When asked if they used Google Scholar to support learning and teaching (figure 6.6), the aggregate results changed considerably from the aggregate figure for the use of Google: 18 participants used Google Scholar frequently, 22 used it sometimes, 6 rarely, and 21 never. For the sub-categories, 6 lecturers used Google Scholar frequently, 13 sometimes, 2 rarely and 8 never (figure 6.7). Eight students used Google Scholar frequently, 6 sometimes, 4 rarely and 11 never (figure 6.8). For the others (figure 6.9), the distribution of results was 4 frequently, 3 sometimes and 2 never. The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of Google Scholar ($U = 387$; $z = -.545$; $p = .586$).

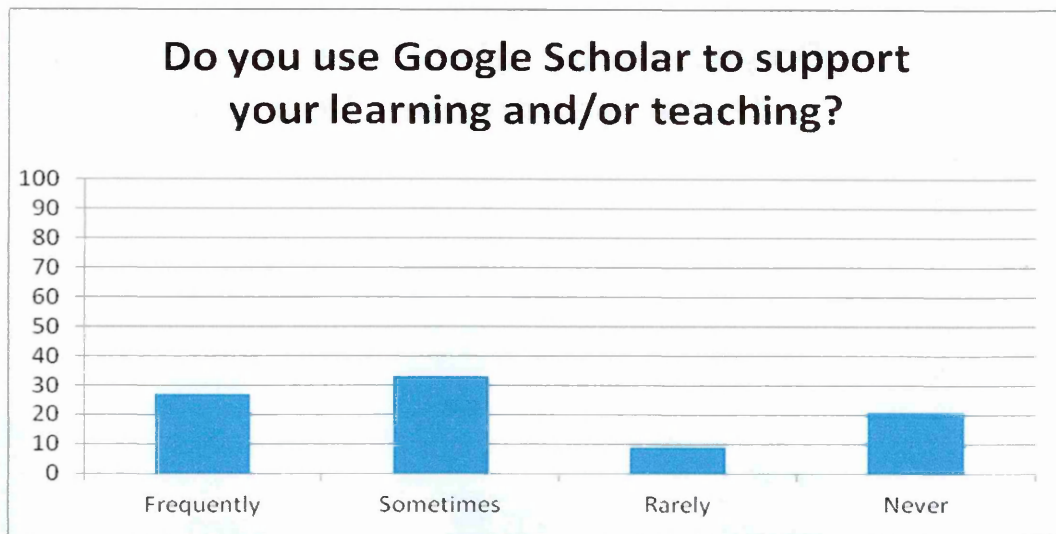


Figure 6.6 Do you use Google Scholar to support your learning and/or teaching?

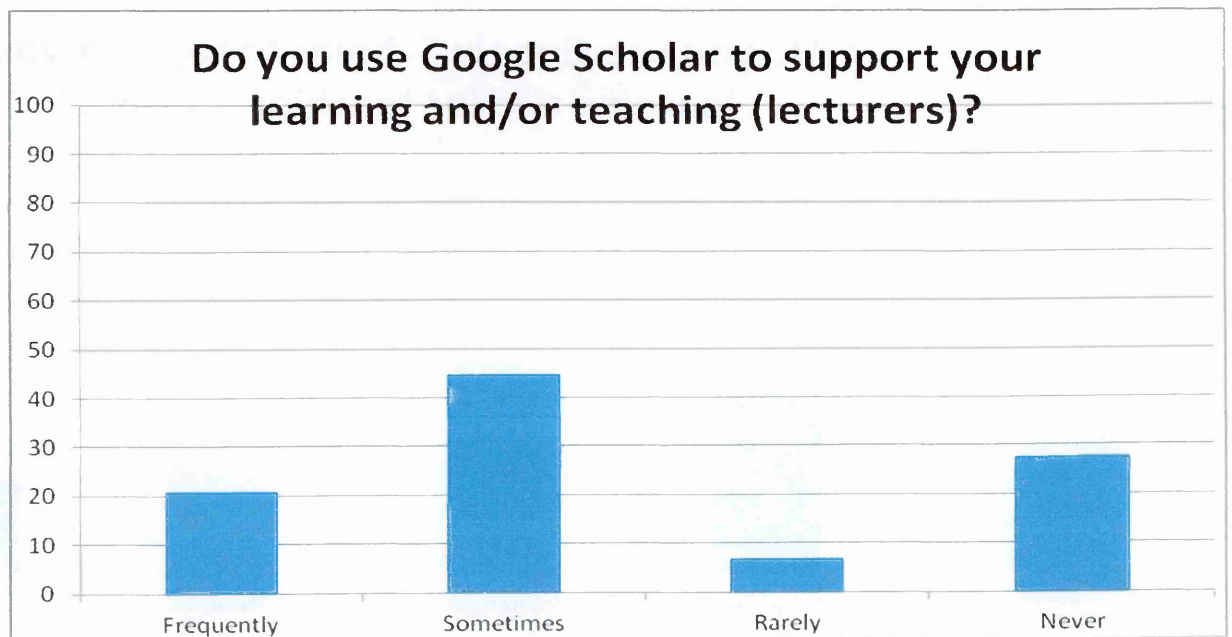


Figure 6.7 Do you use Google Scholar to support your learning and/or teaching (lecturers)?

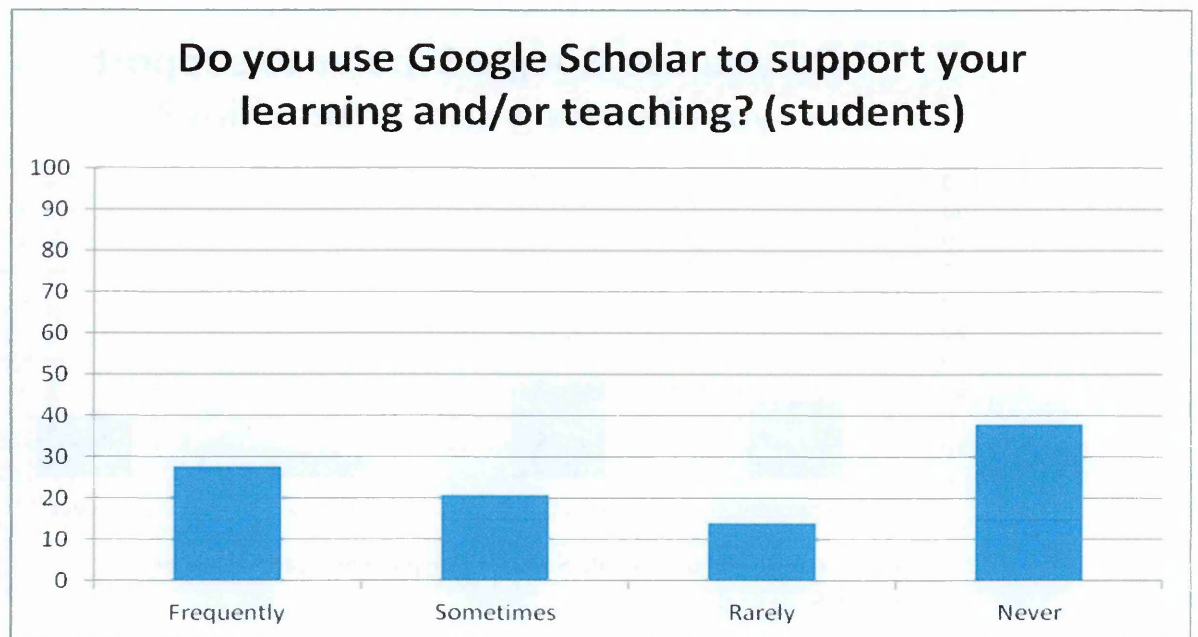


Figure 6.8 Do you use Google Scholar to support your learning and/or teaching (students)?

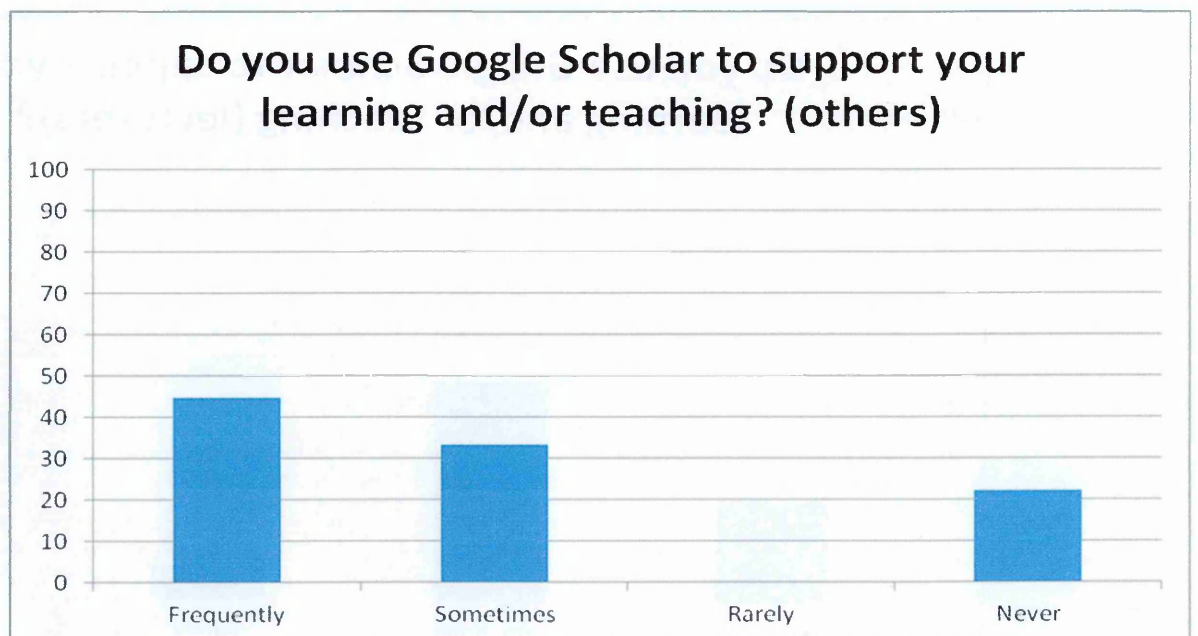


Figure 6.9 Do you use Google Scholar to support your learning and/or teaching (others)?

The reasons for the different pattern of usage between Google and Google Scholar may be various. It may simply be the case that Google Scholar is

not as well known as Google, although, as all the participants work or study in higher education, it seemed likely that a large majority of the participants would have heard of Google Scholar. It may, alternatively, be the case that Google is the first web page participants call up when they log-on, and therefore, as Google is convenient, free, and easy to use, as per Christensen's definition of a disruptive technology (1997, p.xv), Google gets used in preference to Google Scholar. In addition, it may simply be the case that participants are able to get the job done with Google and thus do not look any further. In addition, while 65.5% of lecturers used Google Scholar frequently or sometimes, only 48.3% of students did. The reason for this may be that Google Scholar is perceived as more of a niche source for academics than a tool to perform a job for students. In the latter case, Google itself is the disruptive technology, with Google Scholar being perceived as a sustaining technology, offering marginal performance improvements in relation to Google.

When asked if they used an academic journal aggregator (e.g., Academic Search Complete), the participants' responses in aggregate were similar to when they were asked if they used Google Scholar (figure 6.10). Eighteen participants used an academic journal aggregator frequently, 19 sometimes, 4 rarely and 26 never. When broken down into its sub-categories, the results showed 8 lecturers used an academic journal aggregator frequently, 11 sometimes, 2 rarely and 8 never (figure 6.11). Seven students (figure 6.12) used an academic journal aggregator frequently, 8 sometimes and 14 never. Regarding the others, 3 used an academic journal aggregator

frequently, 2 rarely and 4 never (figure 6.13). The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of an academic journal aggregator ($U = 355$; $z = -1.078$; $p = .281$).

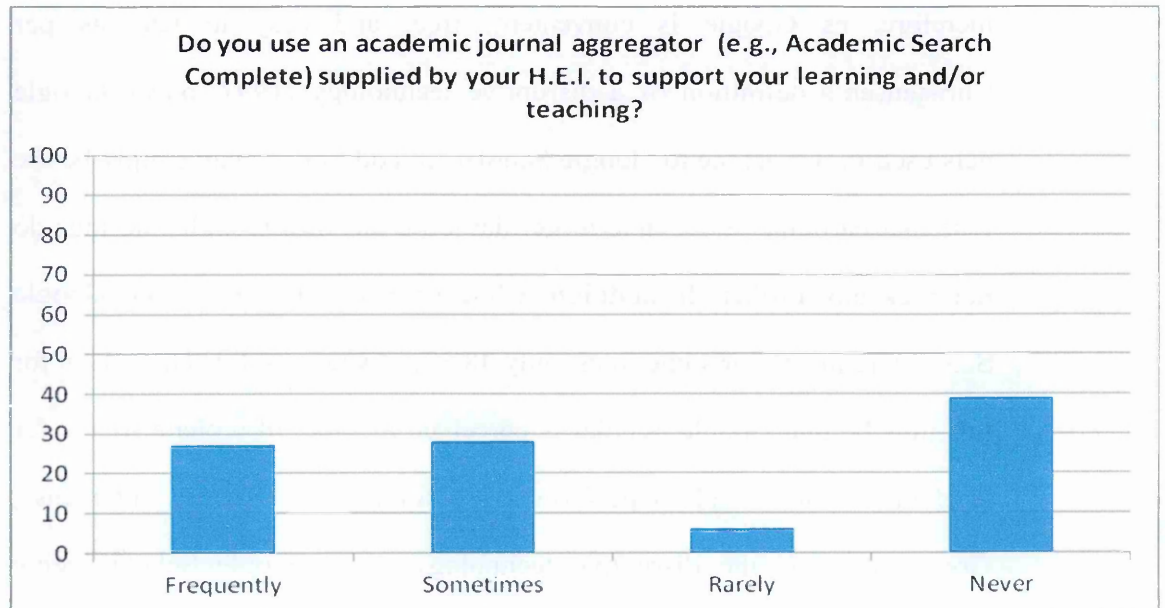


Figure 6.10 Do you use an academic journal aggregator (e.g., Academic Search Complete) supplied by your HEI to support your learning and/or teaching?

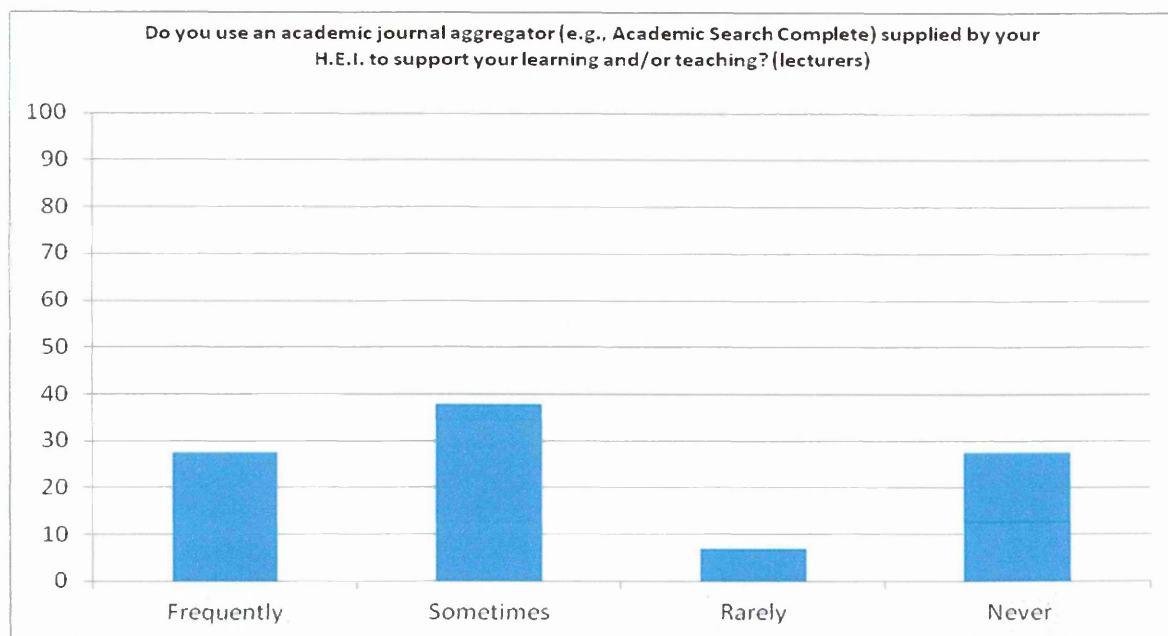


Figure 6.11 Do you use an academic journal aggregator (e.g., Academic Search Complete) supplied by your HEI to support your learning and/or teaching (lecturers)?

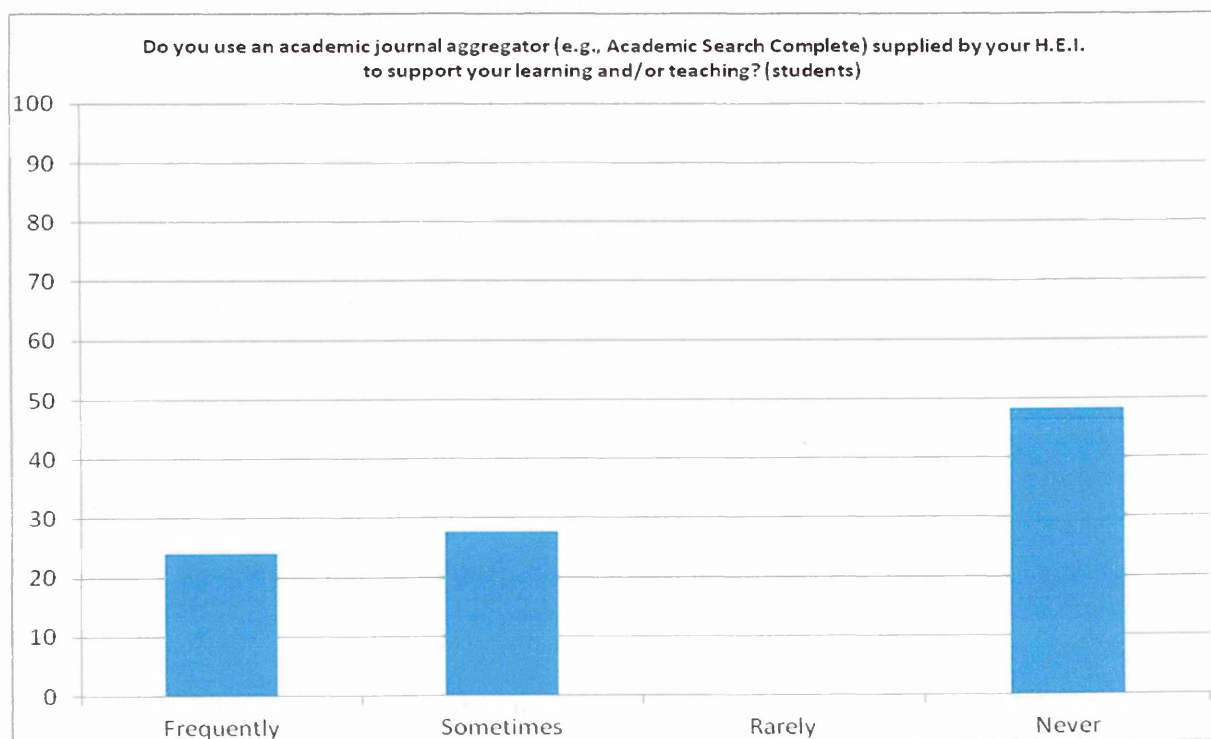


Figure 6.12 Do you use an academic journal aggregator (e.g., Academic Search Complete) supplied by your HEI to support your learning and/or teaching (students)?

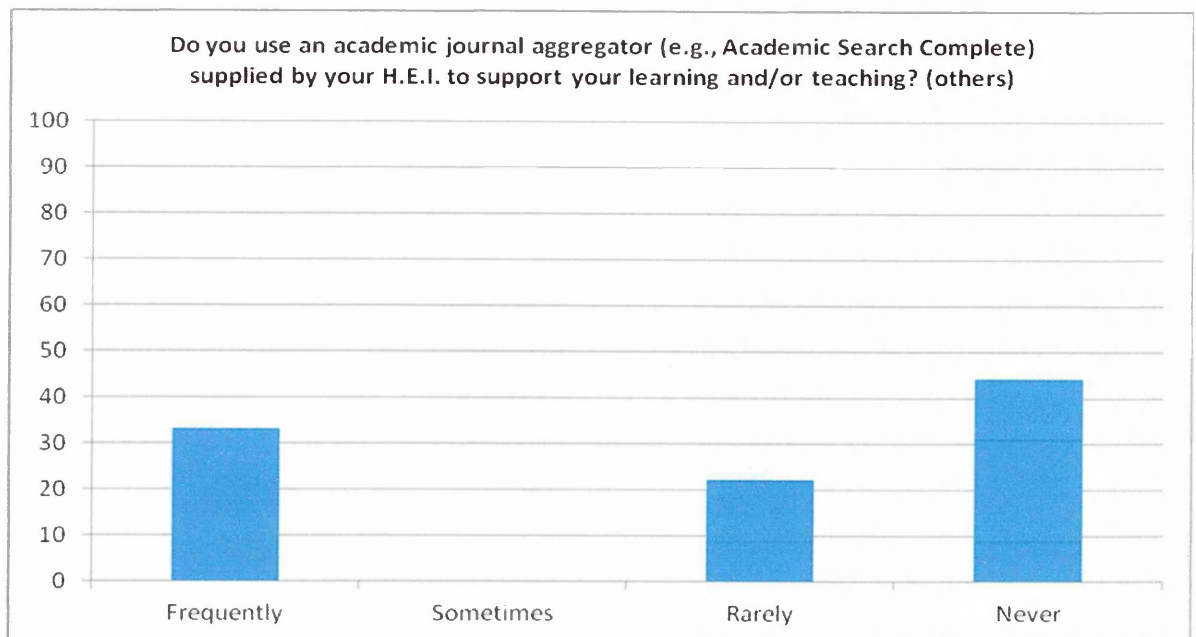


Figure 6.13 Do you use an academic journal aggregator (e.g., Academic Search Complete) supplied by your HEI to support your learning and/or teaching (others)?

Accessing Google Scholar tends to be easier than accessing an academic journal aggregator (the latter requiring mediation through an HEI's home page), but this does not seem to have a notable impact for the aggregate statistics on usage, which was similar for both technologies. It is possible that participants see a clear value in using Google, and some specific value in using an academic journal aggregator, but see limited value in Google Scholar as a "halfway house" technology. It is possible, therefore, that Google Scholar has more of the features of a sustaining rather than disruptive technology, offering a niche service that overlaps considerably with what is already available, and thereby offering only a marginal improvement. It is further apparent, from the sample, that more students never use an academic journal aggregator than is the case for lecturers

(48.3% as opposed to 27.5%). In common with the sub-divided statistics for Google Scholar, it is possible that the academic journal aggregator is perceived as a niche service for academics, whereas Google is perceived as a simple and convenient tool to get jobs done, and targeted at a wider audience.

The survey findings on Wikipedia suggested that it is used to a notable extent. Eleven of the aggregate participant used it frequently, 29 sometimes, 21 rarely, and 6 never (figure 6.14). Regarding lecturers only, 5 used it frequently, 12 sometimes, 8 rarely and 4 never (figure 6.15). Six students used Wikipedia frequently, 11 sometimes, 10 rarely and 2 never (figure 6.16). Six of the others (figure 6.17) used Wikipedia sometimes, 3 rarely. The percentage figure for lecturers who used Wikipedia frequently or sometimes was 58.6%, almost exactly the same as the figure for students (58.5%). The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of Wikipedia ($U = 400$; $z = -.336$; $p = .737$). Wikipedia as a tool and as a disruptive technology would seem to be capable of getting jobs done for people occupying various roles in the academic community. Conforming to Christensen's criteria (1997, p.xv), Wikipedia disrupts pre-digital tools for producing, sharing and using knowledge, by virtue of its simplicity and convenience.

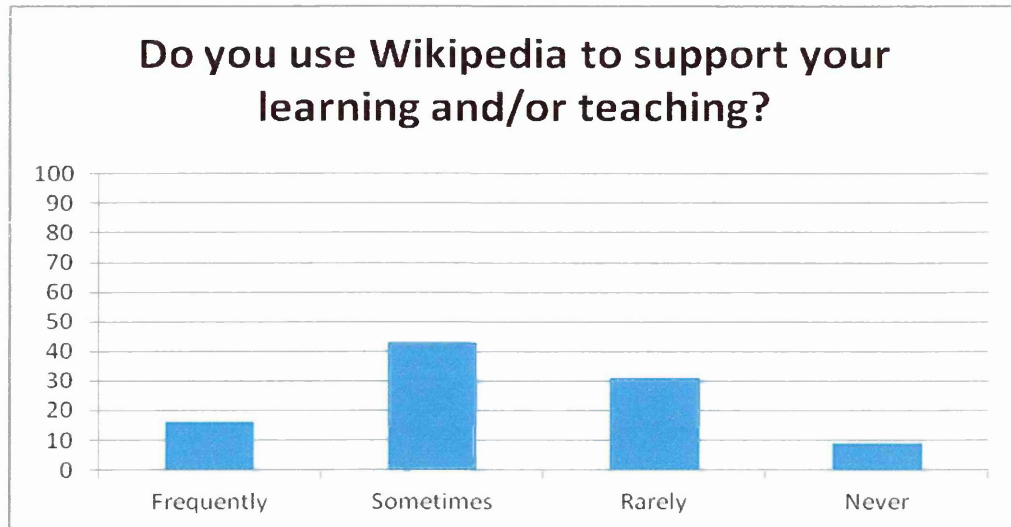


Figure 6.14 Do you use Wikipedia to support your learning and/or teaching?

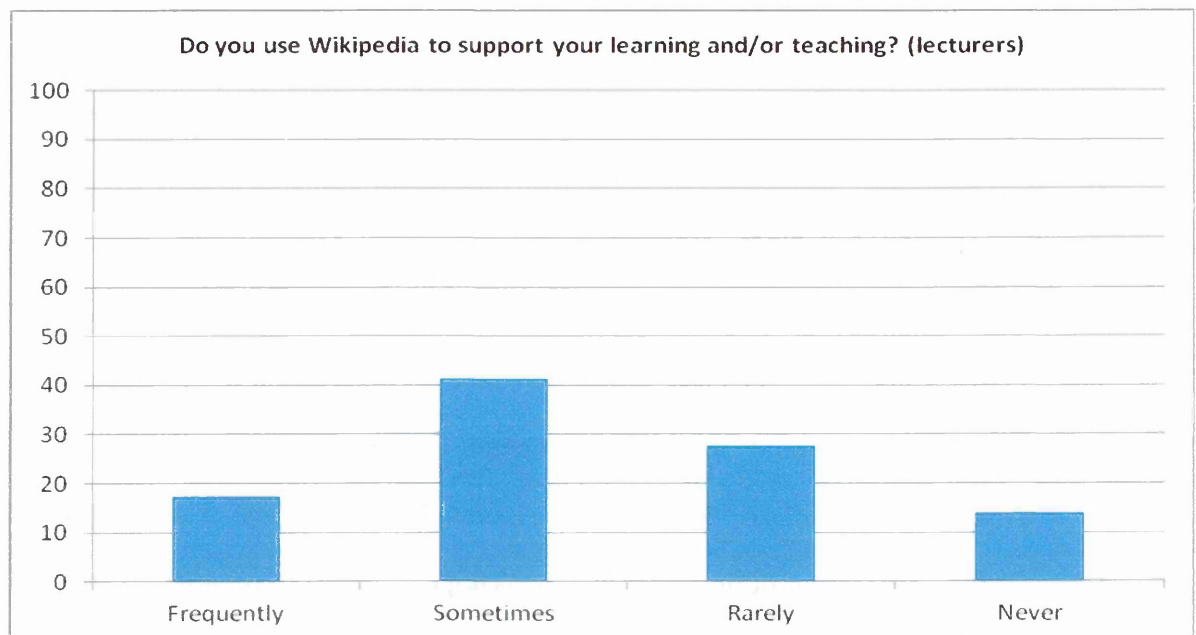


Figure 6.15 Do you use Wikipedia to support your learning and/or teaching (lecturers)?

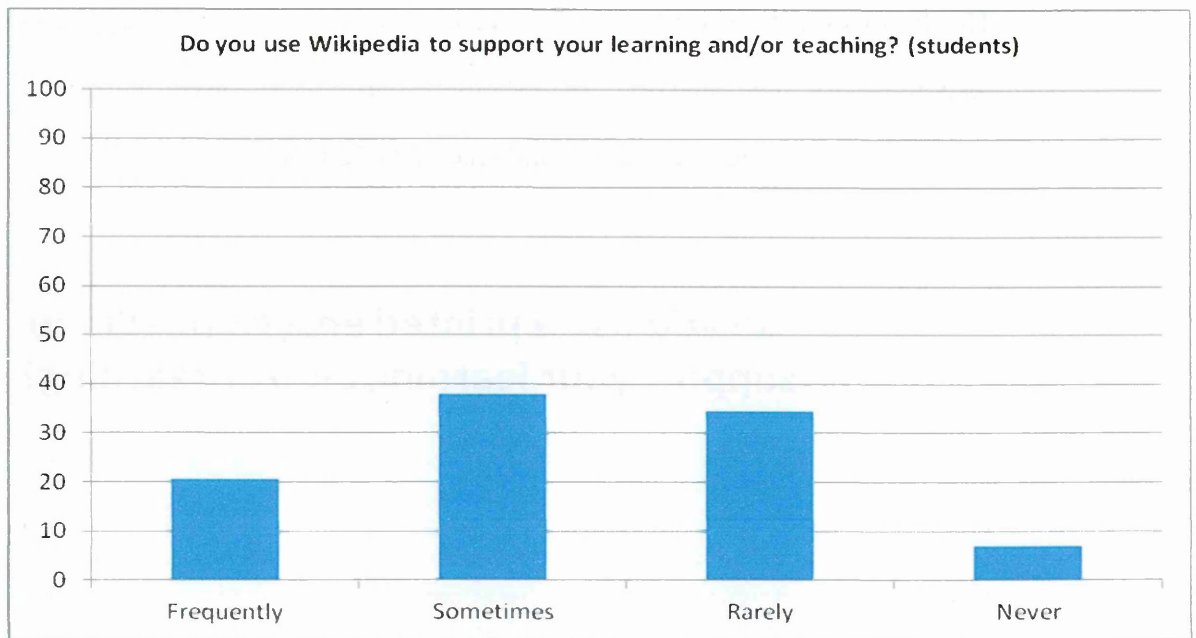


Figure 6.16 Do you use Wikipedia to support your learning and/or teaching (lecturers)?

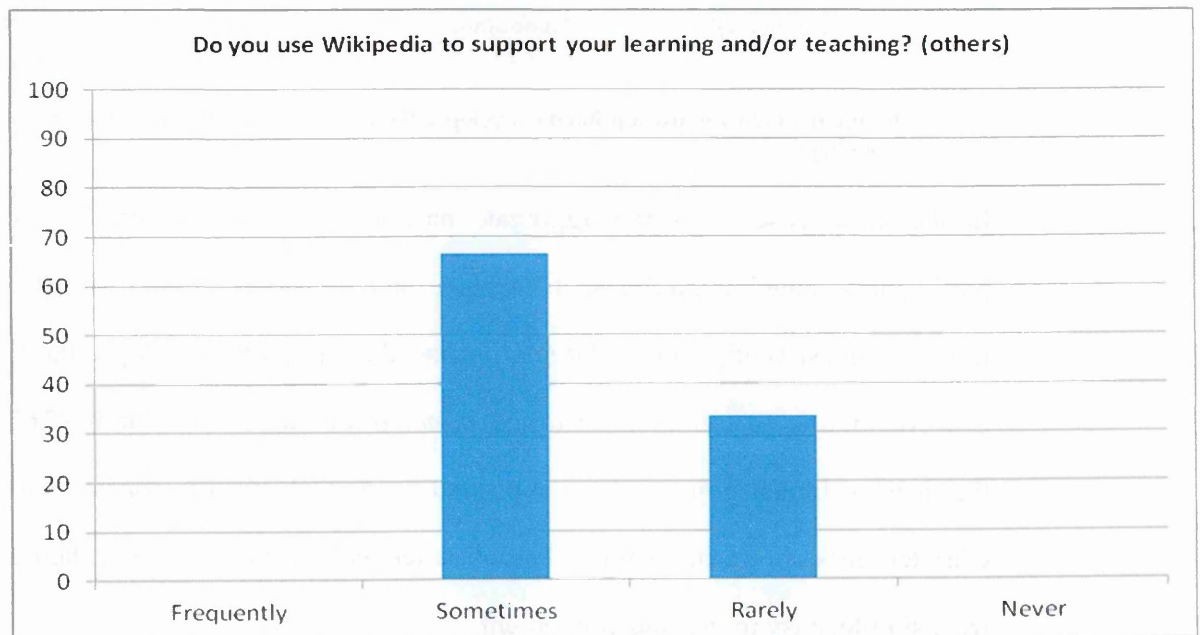


Figure 6.17 Do you use Wikipedia to support your learning and/or teaching (others)?

The figures on the use of Wikipedia can be contrasted with the aggregate responses to the question of whether participants used a printed encyclopaedia to support learning and teaching (figure 6.18).

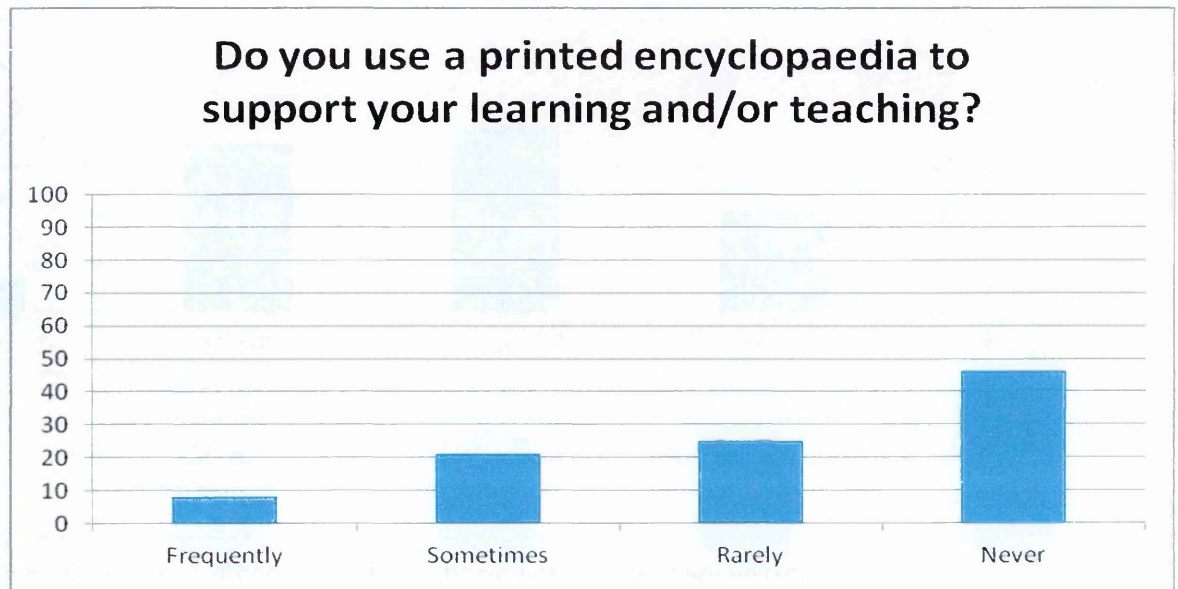


Figure 6.18 Do you use a printed encyclopaedia to support your learning and/or teaching?

In the latter case, 5 of the aggregate participants stated frequently, 14 participants stated sometimes, 17 rarely, and 31 never. The aggregate figures suggest Wikipedia has largely displaced the printed encyclopaedia; it is worth noting that *Encyclopaedia Britannica* announced in March 2012 that it is no longer going to issue a printed version. Wikipedia conforms to Christensen's core criteria for a disruptive technology (1997, p. xv), being free, simple, easy to use and convenient.

When the data is broken down into its sub-categories, it emerges that 3 lecturers used a printed encyclopaedia frequently, 8 sometimes, 7 rarely and 11 never (figure 6.19). For students in the sample, 2 used a printed

encyclopedia frequently, 6 sometimes, 7 rarely and 14 never (figure 6.20).

The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of printed encyclopaedias ($U = 365.5$; $z = -.906$; $p = .365$). Regarding the others, 3 used a printed encyclopedia rarely, 6 never (figure 6.21). Lecturers are making more use of printed encyclopaedias than the other categories, but even in this instance over half the lecturers used printed encyclopaedias rarely or never.

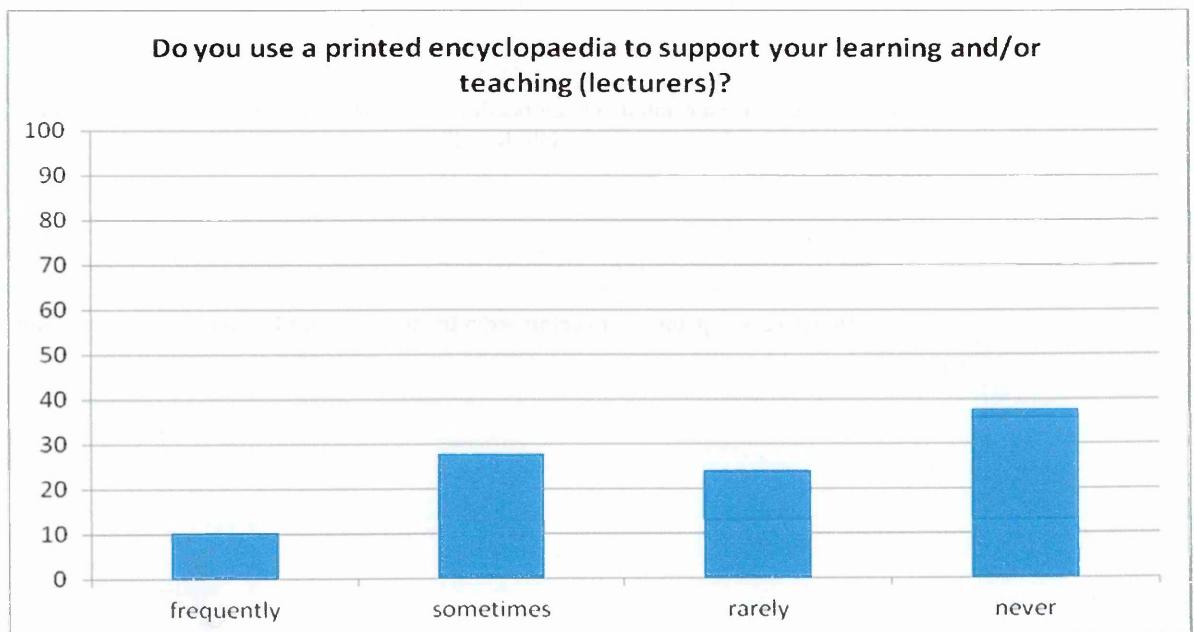


Figure 6.19 Do you use a printed encyclopedia to support your learning and/or teaching (lecturers)?

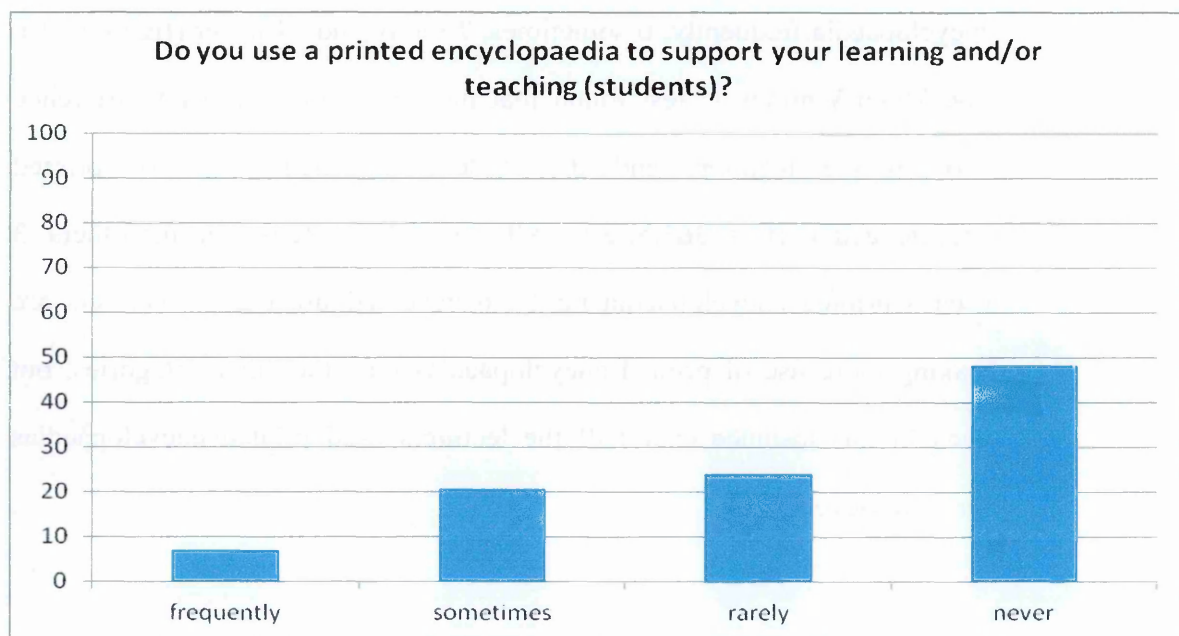


Figure 6.20 Do you use a printed encyclopaedia to support your learning and/or teaching (students)?

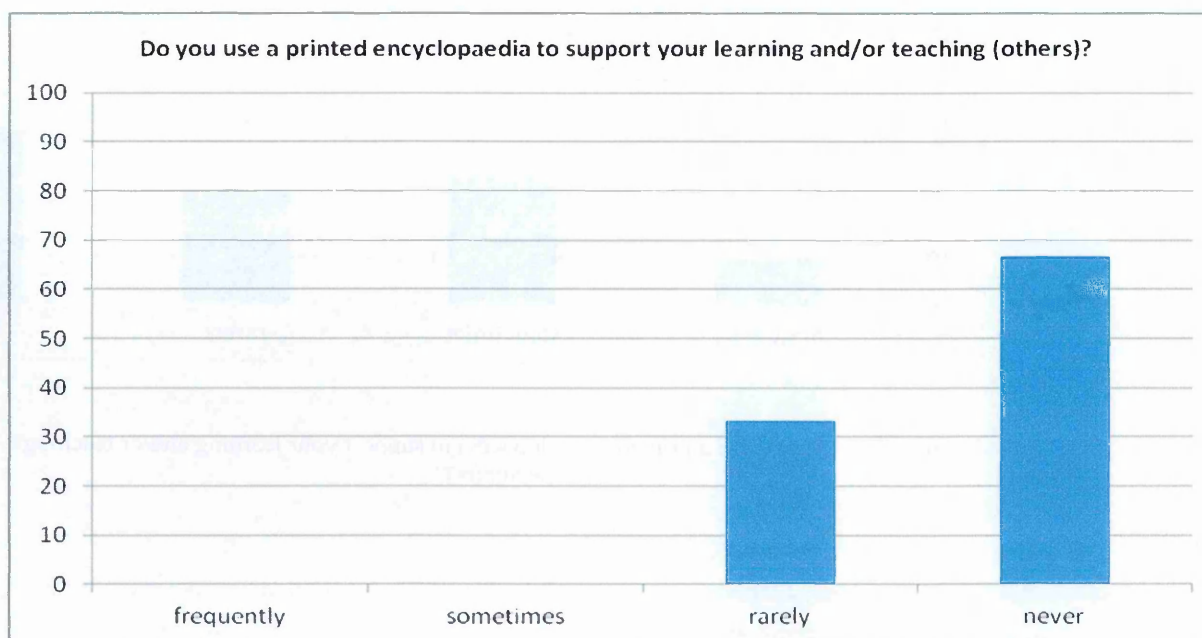


Figure 6.21 Do you use a printed encyclopaedia to support your learning and/or teaching (others)?

The participants were also asked how often they use an HEI's VLE to support their learning and teaching. Nine of the aggregate sample answered "every day," 19 answered "most days," 21 "sometimes," 10 "rarely", and 8 "never" (figure 6.22). For the sub-categories, 7 lecturers used a VLE every day, 9 most days, 9 sometimes, 2 rarely and 2 never (figure 6.23). One student answered "every day," 7 answered "most days," 9 "sometimes," 6 "rarely" and 6 "never" (figure 6.24). One of the others answered "every day," 3 "most days," 3 "sometimes" and 2 "rarely" (figure 6.25). The Mann-Whitney U test found that there was a significant difference between the lecturers and the students in their usage of their institutions' VLEs ($U = 248.5$; $z = -2.757$; $p = .006$). Relating this finding to figures 6.23 and 6.24, lecturers were making more frequent use of their institutions' VLES than students, and the number of students using their HEI's VLE rarely or never was higher than for lecturers. It is possible that the lecturers are using the VLEs to make content available for students; the survey did not pursue this possibility, but it would be consistent with the findings of Blin and Munro (2008), with their research showing high levels of adoption of the VLE by lecturers.

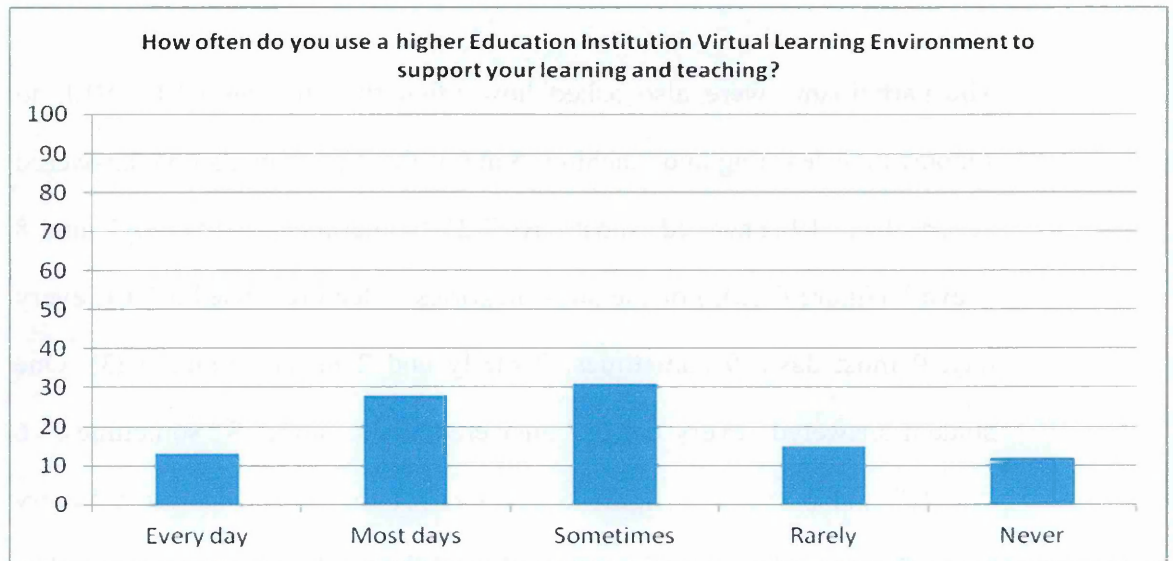


Figure 6.22 How often do you use a Higher Education Institution Virtual Learning Environment to support your learning and teaching?

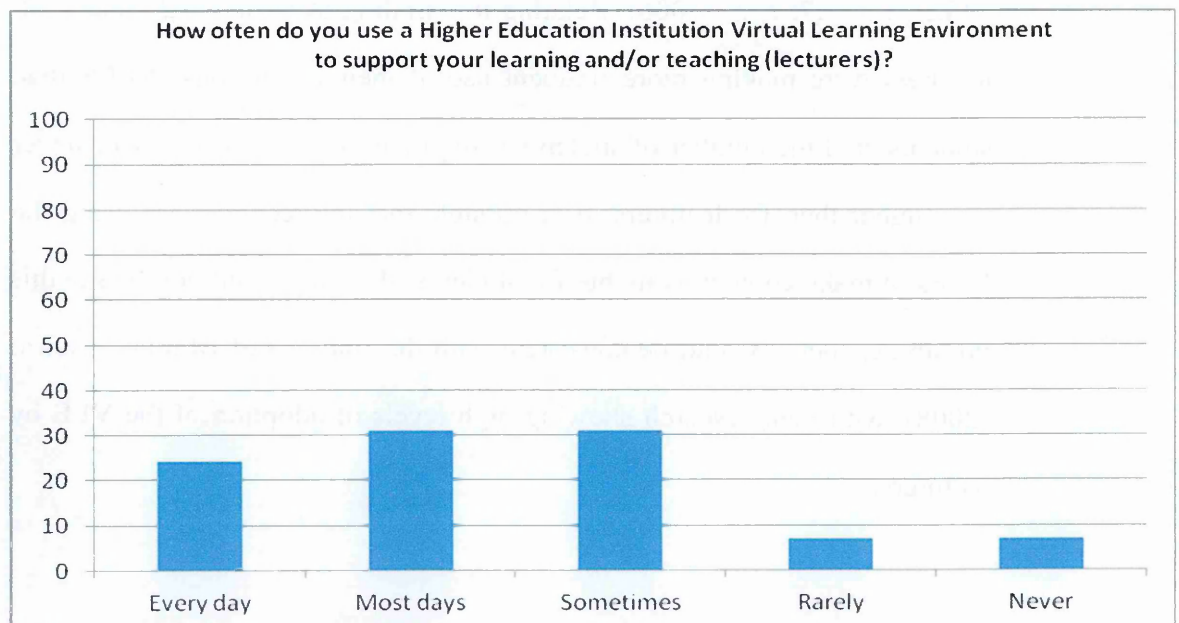


Figure 6.23 How often do you use a Higher Education Institution Virtual Learning Environment to support your learning and teaching (lecturers)?

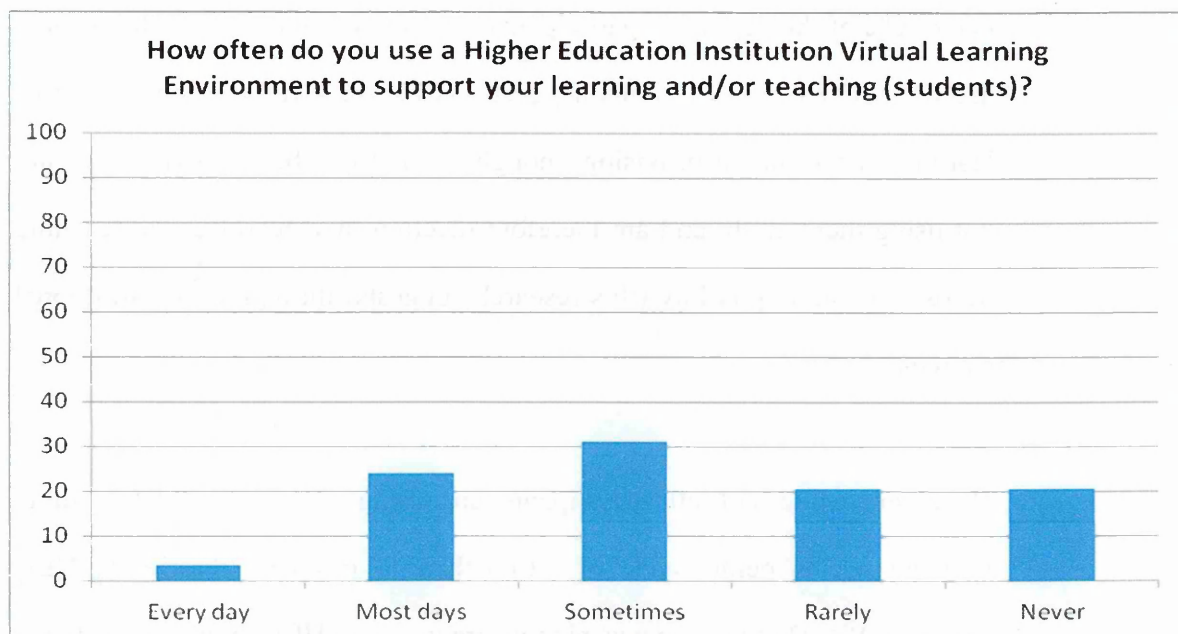


Figure 6.24 How often do you use a Higher Education Institution Virtual Learning Environment to support your learning and teaching (students)?

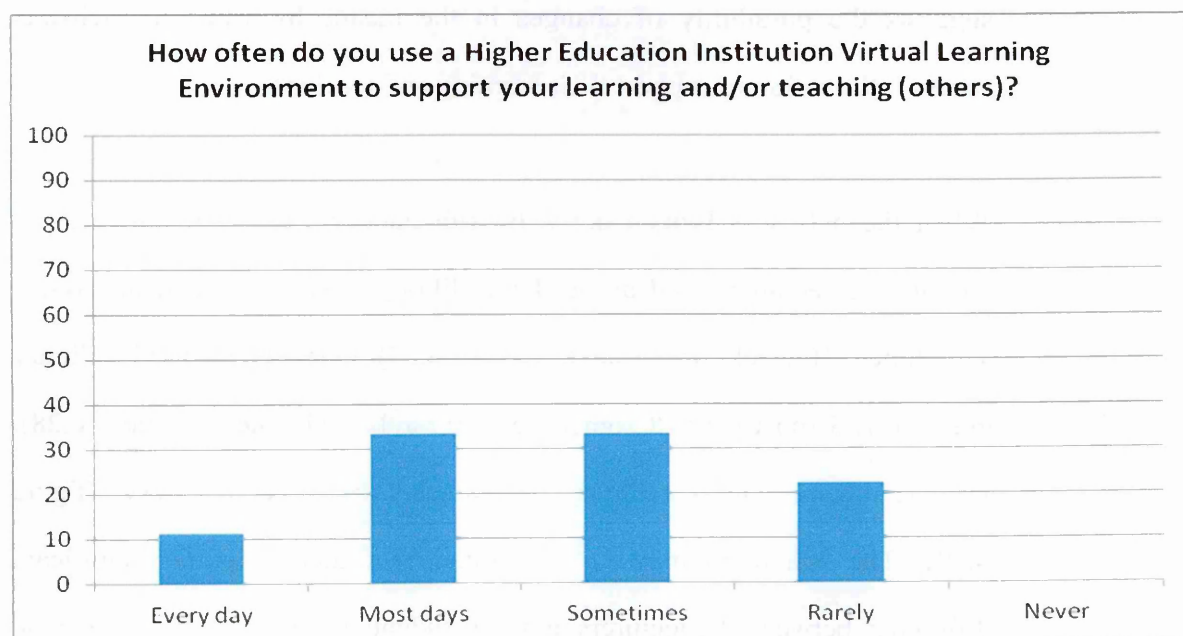


Figure 6.25 How often do you use a Higher Education Institution Virtual Learning Environment to support your learning and teaching (others)?

Over 70% of the aggregate participants were therefore making at least some use of their HEI's VLE. This suggests VLEs are a fully accepted part of learning and teaching provision, though a small number of participants are not using them at all, and are therefore meeting their learning and teaching needs elsewhere, possibly (this research suggests) through non-institutional sources.

However, while not all participants are using their HEI's VLE, more frequent use is being made of VLEs than of physical libraries at HEIs (figure 6.26). Three of the participants are using an HEI library every day, 5 frequently, 20 sometimes, 22 rarely, and 17 never. Just over 50% of aggregate participants rarely or never use an academic library, which suggests the possibility of changes in the means by which participants access information to support their learning and teaching.

When the data was broken down by sub-category, the following figures emerged: 2 lecturers used an academic library every day, 2 most days, 8 sometimes, 10 rarely and 7 never (figure 6.27). One student used a library every day, 3 most days, 8 sometimes, 10 rarely and 7 never (figure 6.28). For the others, 4 used a library sometimes, 2 rarely and 3 never (figure 6.29). The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of academic libraries ($U = 418.5$; $z = -.032$; $p = .974$).

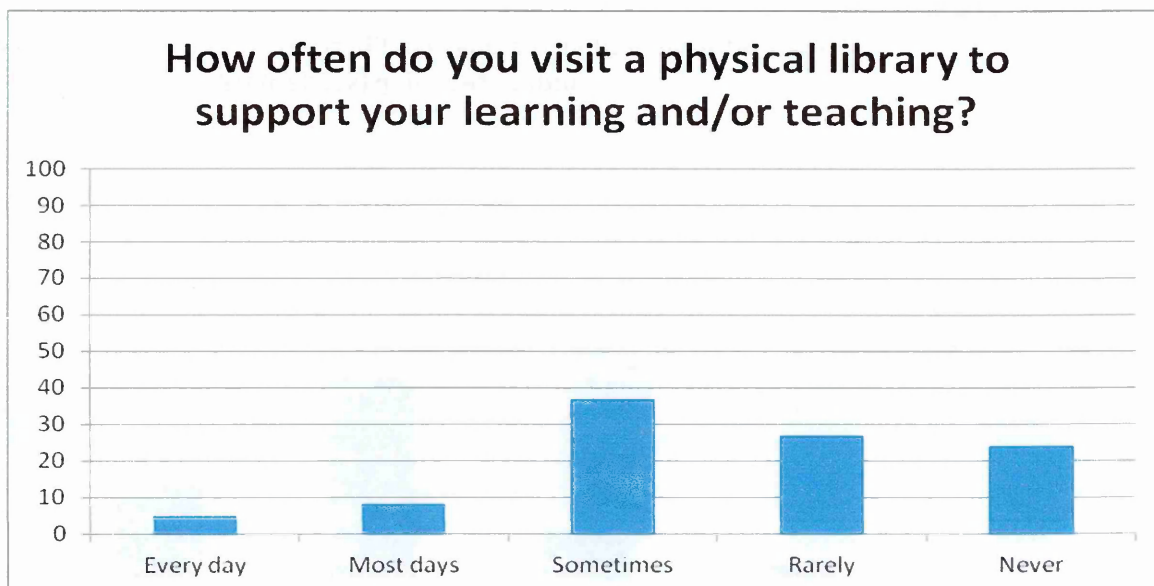


Figure 6.26. How often do you visit a physical library to support your learning and/or teaching?

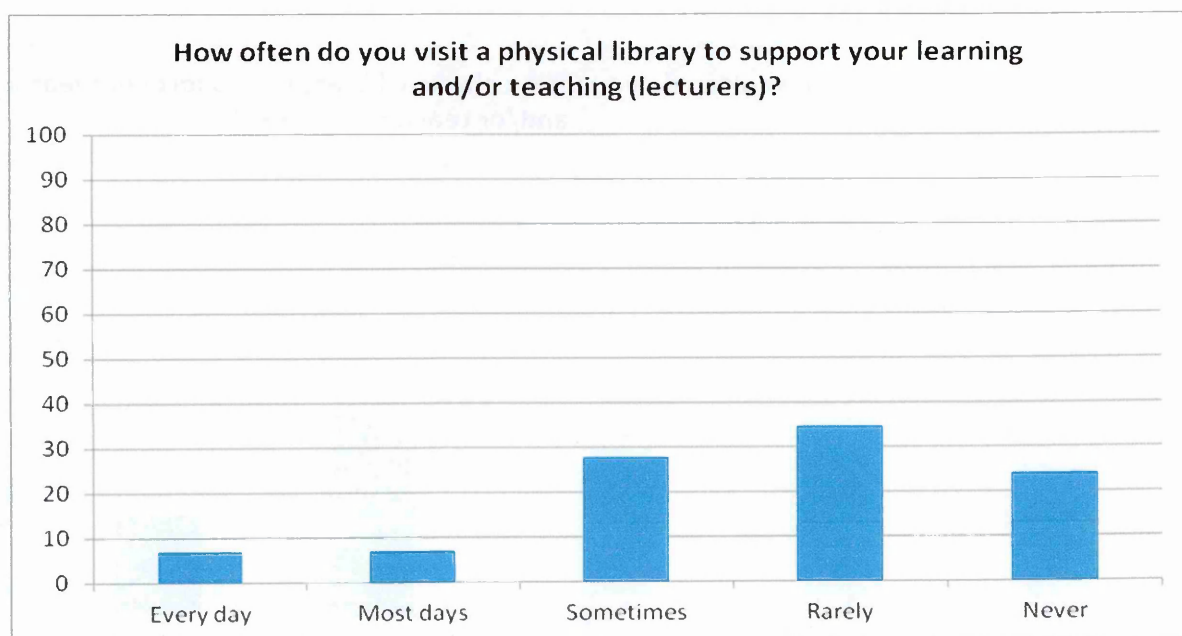


Figure 6.27. How often do you visit a physical library to support your learning and/or teaching (lecturers)?

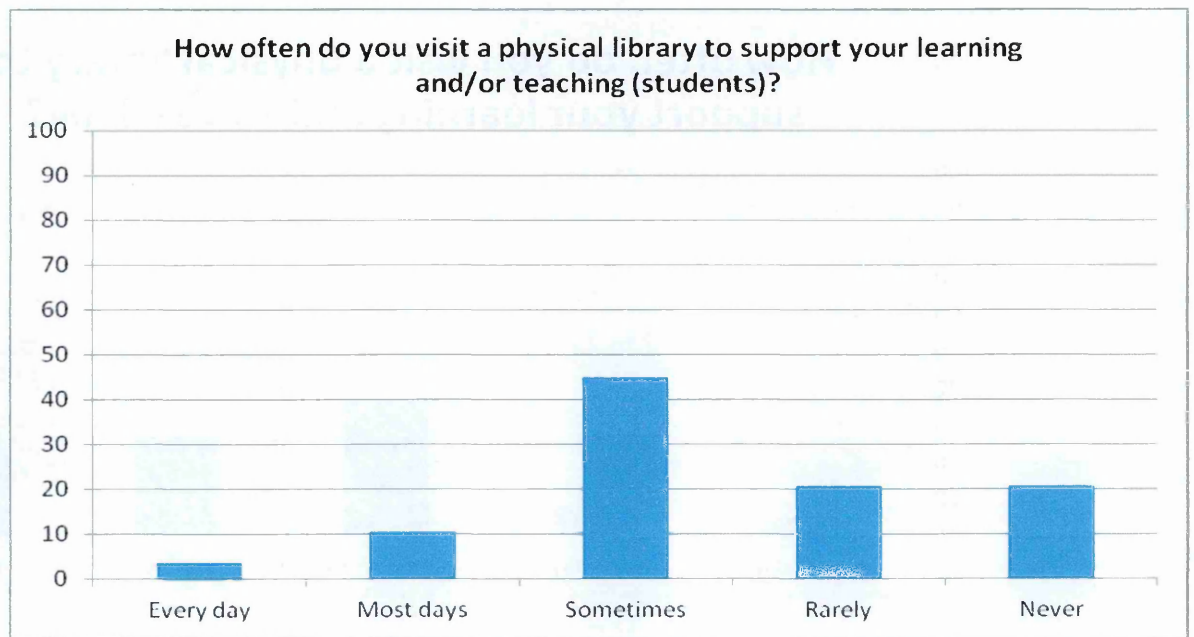


Figure 6.28. How often do you visit a physical library to support your learning and/or teaching (students)?

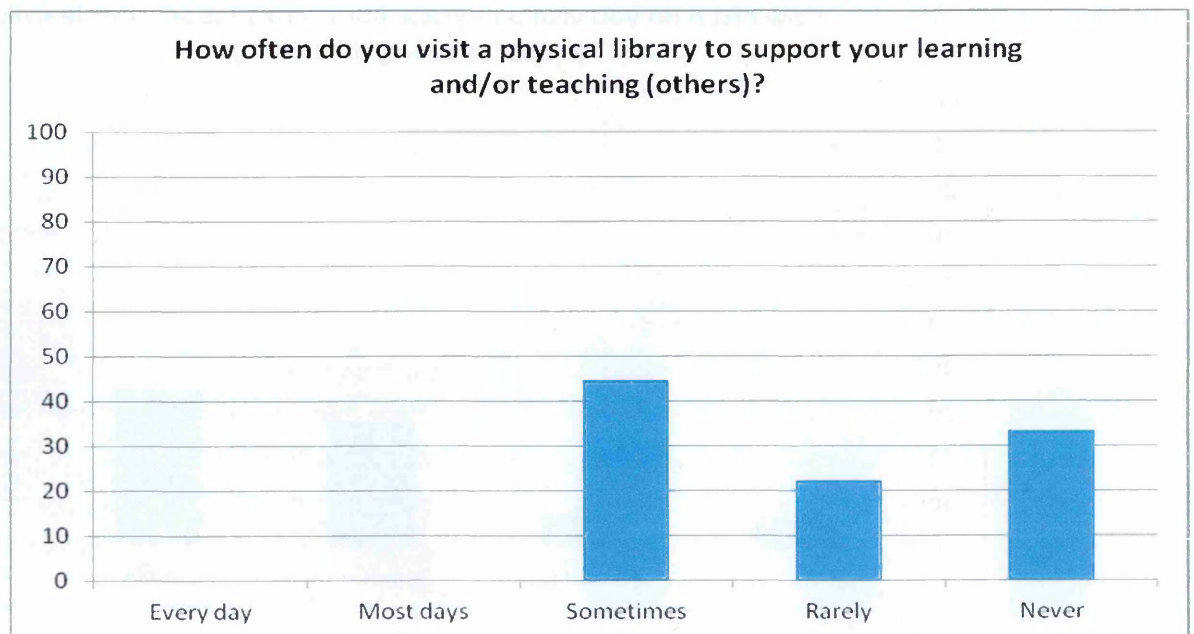


Figure 6.29. How often do you visit a physical library to support your learning and/or teaching (others)?

A common conception of twenty-first century learning and teaching is that it is characterised by the use of a wide range of technologies to support learning and teaching (see, for example, Prensky, 2001). However, the results of the survey indicate otherwise (figure 6.30). According to the aggregate responses, 51 never use Facebook to support learning and teaching, 49 never use Twitter to support learning and teaching, and 43 never use LinkedIn to support learning and teaching.

When the data is broken down into its sub-categories (see figures 6.31-6.33, in which the colour coding from figure 6.30 is maintained) it shows that 1 lecturer used Facebook frequently, 2 used Facebook sometimes, 3 rarely, 23 never. Two students used Facebook frequently, 2 used Facebook sometimes, 4 rarely and 21 never. For the others, 1 used Facebook sometimes, 1 rarely and 7 never. A Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of Facebook to support learning and teaching ($U = 390.5$; $z = -.623$; $p = .533$).

The data for Twitter showed that 1 lecturer used it frequently, 1 used Twitter sometimes, 5 rarely and 22 never. One student used Twitter frequently, 1 sometimes, 2 rarely and 25 never. For the others, 2 used Twitter frequently, 2 sometimes, 3 rarely and 2 never. The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of Twitter to support learning and teaching ($U = 380$; $z = -.922$; $p = .356$).

The data for LinkedIn showed that 1 lecturer used LinkedIn frequently, 6 sometimes, 9 rarely and 13 never. No students used LinkedIn frequently, 2 used it sometimes, 2 rarely and 25 never. For the others, 3 used in LinkedIn sometimes, 1 rarely and 5 never. The Mann-Whitney U test found that there was a significant difference between the lecturers and the students in their usage of LinkedIn to support learning and teaching ($U = 247.5$; $z = -3.194$; $p = .001$). Lecturers were making more use of LinkedIn than students (perhaps reflecting LinkedIn's purpose as a site for networking amongst professionals), but it is also worth noting that the use of LinkedIn as a whole was still at modest levels within the context of the overall sample.

The data for You Tube showed that 3 lecturers used it frequently, 14 sometimes, 7 rarely and 5 never. Three students used You Tube frequently, 15 sometimes, 7 rarely and 4 never. For the others, 1 used You Tube frequently, 5 sometimes, 1 rarely and 2 never. The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their usage of You Tube to support learning and teaching ($U = 404$; $z = -.277$; $p = .782$). In general, students were no more inclined to use social networking technologies than lecturers, implying that there is no noteworthy gap in generational terms when it comes to technology use to support learning and teaching, thereby challenging the digital natives hypothesis (Prensky, 2001).

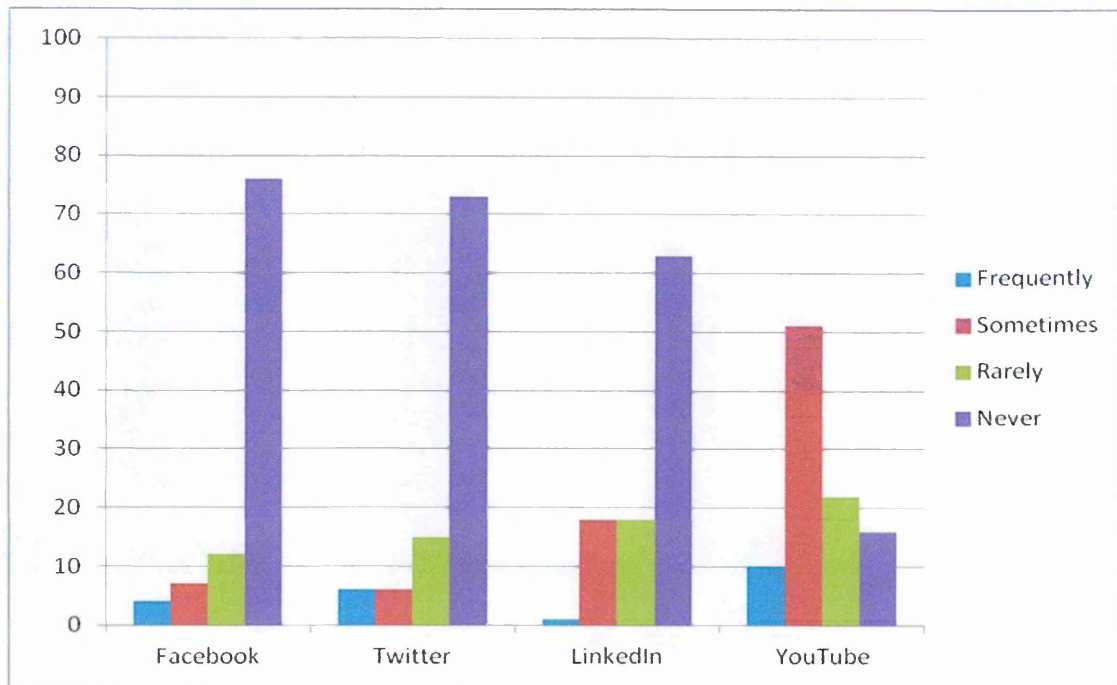


Figure 6.30 Do you use social networking technologies to support your learning and/or teaching?

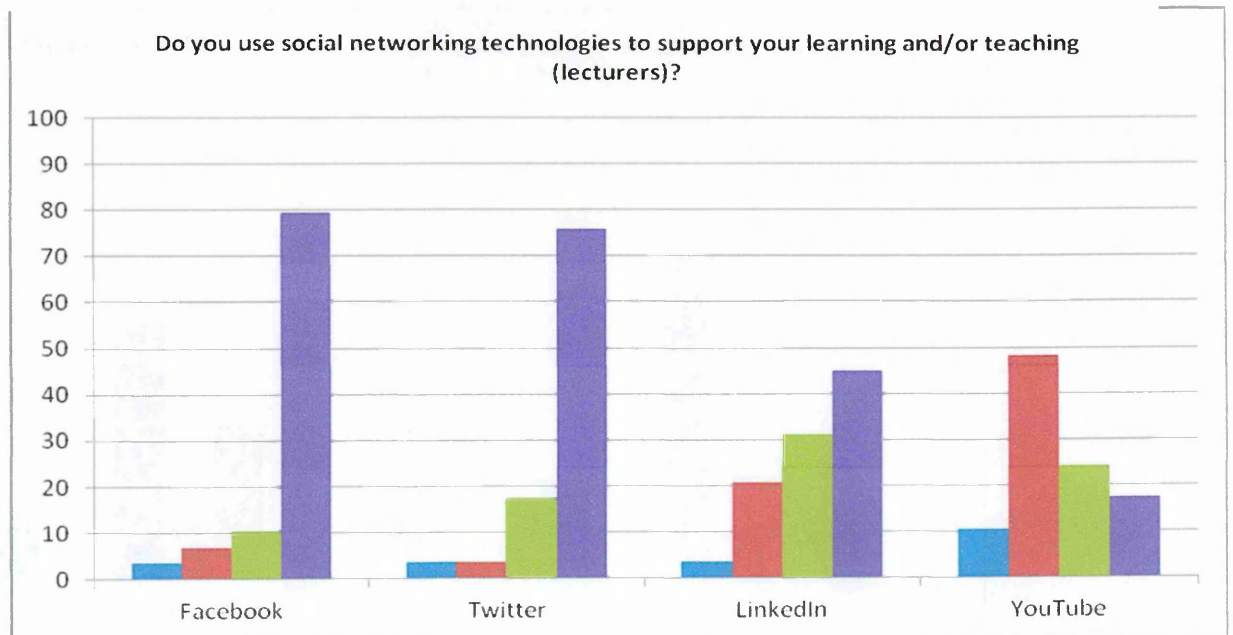


Figure 6.31 Do you use social networking technologies to support your learning and/or teaching (lecturers)?

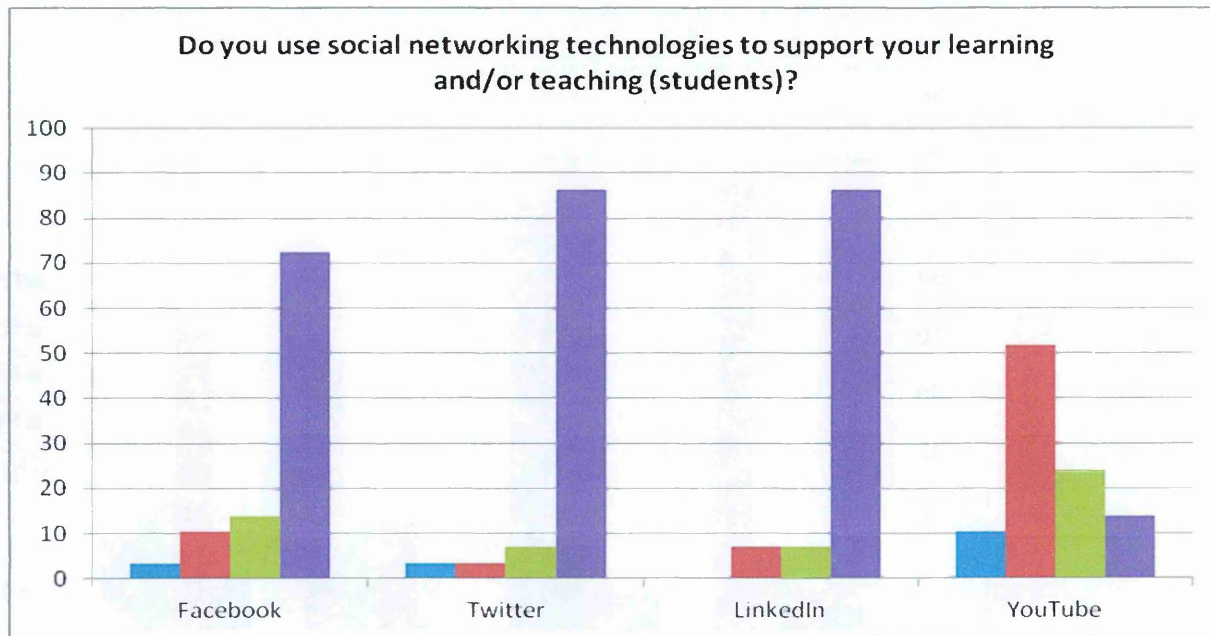


Figure 6.32 Do you use social networking technologies to support your learning and/or teaching (students)?

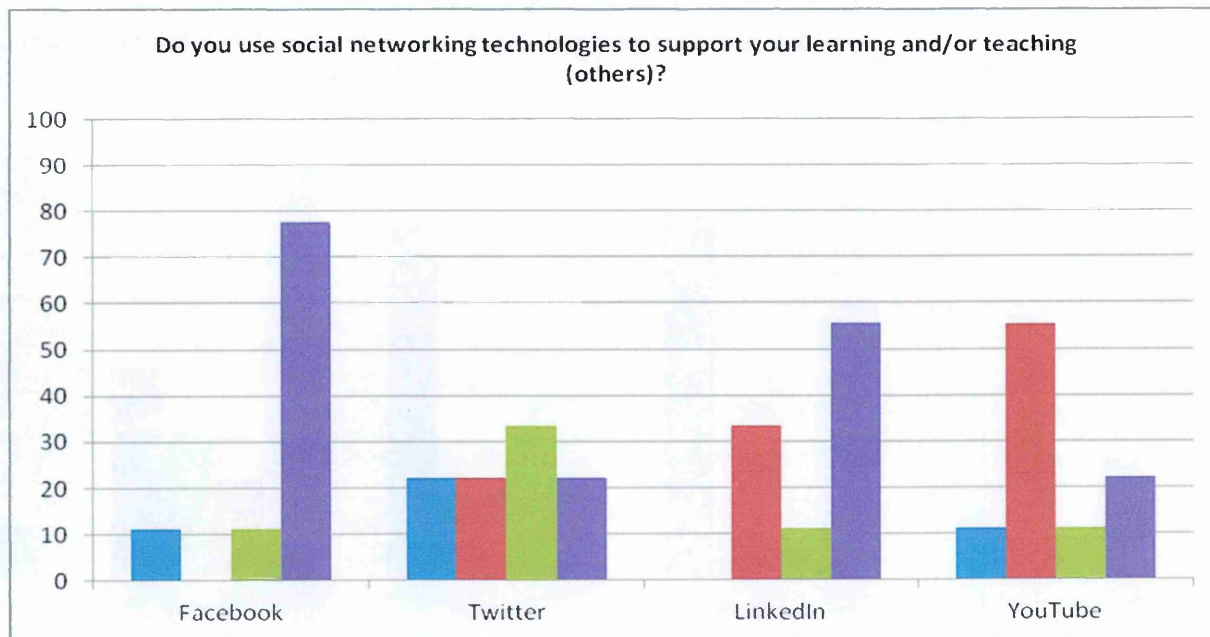


Figure 6.33 Do you use social networking technologies to support your learning and/or teaching (others)?

It appears, again, that participants demarcate in their use of technologies, using separate technologies to support their learning and teaching lives on one hand, and their social lives on the other. Technologies that would appear to have disruptive potential, by blurring the lines between study and recreation, are not being used disruptively. Instead, users are selecting a technology tool for each job they wish to undertake. Disruptive practice is occurring in the form of non-institutional technologies being used to support learning and teaching, for example Google and Wikipedia, but users also draw upon different technologies to support different aspects of their lives. There is no evidence from this survey to support the hypothesis of a plethora of technologies being used to support learning and teaching in higher education. That said, the results for You Tube are distinct from those of the other technologies featured in the survey. One reason for this may be the fact that many universities now have their own You Tube channels, thereby making the learning possibilities of the medium more explicit (Tan and Pearce, 2012; Tan, 2013). Viewed as a second generation activity system, the community is re-purposing a tool in order to serve an object. The learning and teaching possibilities of You Tube may cause it to evolve into a quasi-institutional technology as far as HEIs are concerned, as it allows HEI branding within the You Tube brand, and supplies educational content within a globally popular platform. More broadly, and aside from this research, other recent studies have challenged the extent to which learners and teachers in higher education make use of a wide range of technologies (e.g., Jones and Healing 2010; Margaryan *et al.*, 2011; Timmis, 2012).

The survey also asked participants to evaluate the extent to which they rely on their HEI to support their learning and teaching. Five of the aggregate participant answered “overwhelmingly,” 35 “Largely,” 18 “To some extent,” 6 “Not very much,” and 3 “Not at all.” Therefore, a considerable majority (86.6%) of participants stated they relied on their HEI to support their learning and teaching, to at least some extent. For the sub-category of lecturers, 1 answered “overwhelmingly,” 17 “largely,” 8 “to some extent,” 2 “not very much” and 1 “not at all.” For students, three answered “overwhelmingly,” 15 “largely,” 8 “to some extent,” 2 “not very much” and 1 “not at all.” For the others, 1 answered “overwhelmingly,” 3 “largely,” 2 “to some extent,” 2 “not very much”, and 1 “not at all”. The Mann-Whitney U test found that there was no significant difference between the lecturers and the students in their perception of their reliance on their HEI to support their learning and teaching ($U = 402.5$; $z = -.311$; $p = .756$).

Despite the plethora of alternative routes to knowledge, many of them non-institutional, academic community members still perceive considerable reliance on the HEI to support learning and teaching. This issue was not explored in any further detail in the survey, but it is possible that the first stimulus for object-directed learning still comes from the HEI, with participants then looking for knowledge from various sources, but with a preference for readily available online services. There is also a notable space between what participants declare as their learning and teaching practice, and, via the observations conducted for this research (Phase IV), what they actually do in practice. It may be the case that participants perceive the use

of non-institutional technologies to support learning and teaching as an integrated aspect of their learning and teaching, complementing if not conflating with their learning and teaching directed by their HEI. With disruption emerging in line with practice, as argued by Christensen and Raynor (2003), disruption is not consciously perceived as disruption. Expansive learning (Engeström, 1987) has occurred, fuelled through practice.

Looking at the Mann-Whitney U tests across the survey, there were two questions where a significant difference in usage between lecturers and students emerged. The first related to usage of an HEI's VLE, with more students stating that they rarely or never used their HEI's VLE. The finding reflects the observation studies for this research, in which participants' usage was weighted towards non-institutional sources. The purposes for which academic community members were using VLEs were not explored in this survey. It may be the case that lecturers were using VLEs to deposit learning materials, as found in Blin and Munro's study (2008). In this survey, it was also the case that lecturers were making more use of LinkedIn than students. This may be attributable to the fact that LinkedIn markets itself as a site for professional networking. Lecturers may self-identify as professionals, being more towards the centre of the community of practice (Lave and Wenger, 1991; Wenger, 1998) than students. That said, the overall usage of LinkedIn was still low, in line with the usage of other social networking technologies included in this survey. Moreover, while the statistically significant differences might be due to genuine differences

between the groups of lecturers and students, they might also be due to confounded background variables such as age, gender and academic discipline, which the survey did not record.

6.4.7 Conclusion

With the survey comprising the final iteration of the research, the overall findings were assembled, and the main and sub-research questions addressed. This is dealt with in chapter seven.

CHAPTER 7: DISCUSSION AND FINDINGS

7.1 Introduction

The previous chapter detailed phases IV, V and VI of the research, comprising observations, structured interviews and a final survey. The chapter argued that the participants used a small range of technologies for a wide range of tasks, and used technologies disruptively in the sense identified by Christensen (1997) and Christensen and Raynor (2003), with participants preferring convenient and easy to use technologies, and with purpose being shaped by practice.

This chapter returns to the main and sub-research questions, informed by the literature review and by the research. The chapter looks at the main and the sub-research questions in turn, before offering some overarching remarks, leading towards the final chapter and overall conclusions.

7.2 Addressing the main research question:

How can HEIs in the UK engage constructively with disruptive technologies for learning and teaching?

This research has investigated how HEIs can engage constructively with disruptive technologies for learning and teaching in UK higher education. In some respects, the enabling of disruptive technologies needs no prompting, as it is a core tenet of Disruptive Innovation, as clarified by Christensen and Raynor (2003), that disruption emerges through practice rather than design, and therefore disruption manages itself, in the sense that it emerges from interactions between people and technologies; technologies, this research argues (and in line with Grint and Woolgar, 1997) are essentially inert until they become engaged in human practice. Furthermore, disruption needs no prompting within a second generation activity system, because contradictions accumulate structurally over time (Engeström, 1987, 1999a, 2001), leading to new activity systems and therefore disruption, in the form of contradiction, is assured. However, institutional interventions can be made, enabling the disruptive use of technologies to be better accommodated within learning and teaching; Engeström (1999a, p.385) argues that deliberate intervention is usually required to achieve expansive learning.

The understanding of disruptive technologies has been developed and nuanced, not least in Christensen's own work, as he moved from defining disruptive technologies by four key criteria in 1997, to arguing that disruption is a feature of practice rather than design (Christensen and Raynor, 2003), later refining his position by arguing that disruptive technologies stand the greatest chance of success when they are positioned against non-consumption (Christensen *et al.*, 2008). In addition, other

writers have sub-divided categories of disruptive innovation in different ways (e.g., Moore, 2004; Govindarajan and Kopalle, 2006; Yu and Hang, 2009). Therefore, disruptive technologies as a category resist easy reduction, unless we define disruptive technologies simply as technologies that are disruptive. The definition is less facile than it might at first appear, because the emphasis in disruption is on practice, and it is the use of the technology that comprises the disruption. Disruptive technology is a product of human agency, not a feature of design.

Developing this argument, disruption is a product of human agency, which is then sustained and disseminated through the effectiveness of the practice (the outcome of human agency) in getting jobs done, functioning effectively as a tool, in an activity system sense, and targeted at objects (in the activity system sense of purposes). Disruptive technologies need to attain a coterie of users, achieve critical mass and thus gain an effective foothold; Christensen (1997) provides a case study of Honda motorcycles in the USA, but, in this EdD thesis, a participant who was introduced to a potentially disruptive technology (Wallwisher) did not make use of it, because others were not doing so. When users do network and collaborate, it creates the conditions in which disruptive technology use is more likely to be disseminated. An effective academic community of practice (Lave and Wenger, 1991; Wenger, 1998) can enable the dissemination, through a network that encourages, rather than suppresses innovation (Nickson *et al.*, 2003; Unwin, 2007). From the perspective of disruption as a practice rather than an intention, Christensen's first definition of disruption is still the most

useful, as it argues disruptive technologies are simpler, smaller, cheaper and more convenient than the incumbents they displace (1997, p. xv). Technologies conforming to Christensen's core criteria (Google and Wikipedia, for example, have featured in this research) are more likely to be used, than technologies for which a clear purpose is elusive (Wallwisher and Second Life have both been mentioned as examples in this research in this specific regard).

Disruptive technologies change practice and, as such, they can change social relations, and change higher educational settings, because forms of practice are aligned to specific contexts (a practice can be effective in one context and ineffective in another) and a change in practice changes its context. It would be reductive to argue that context determines practice absolutely, in the same way that technological determinism is reductive (Grint and Woolgar, 1997). In each case, a more nuanced reading would suggest that the practice and its context are in an ongoing process of engagement and exchange. Engeström (1987, 2001) argues that a change in one node in an activity system impacts on all other nodes, and that tools (technologies, in this instance) are, themselves, reconfigured and repurposed through usage (Engeström, 2007). For example, this research has argued that academic community members' construction of knowledge through disruptive technologies not designed for learning and teaching in higher education has implications for the gatekeeper role of the HEI. The disruptive use of technologies has the potential to change aspects of higher education in the UK, and HEIs can engage constructively with disruptive technologies by

recognising disruption as a product of practice, and by recognising the technologies used by academic community members to support their learning and teaching. HEIs can also engage constructively with disruptive technologies by recognising the mismatch between the technologies they provide and the technologies academic community members use, and by rethinking their technology enhanced learning strategies accordingly.

7.3 Addressing sub-research question 1:

What technologies are being used to support learning and teaching in higher education and how are they being used?

This research suggests a small number of technologies are being used to accomplish a wide range of tasks. Furthermore, the technologies that are being used tend to conform to Christensen's core criteria (1997). This research suggests Google and Wikipedia are being used more than institutional VLEs, or academic journal aggregators, or printed encyclopaedias. Conversely, emerging technologies such as Delicious and Prezi are not being used frequently and, moreover, and as suggested in the first two surveys, awareness of these technologies is low.

The research as a whole suggests certain technologies function as hubs; academic community members go to Google first, then to resources identified by Google, as witnessed during the observations. As for why

academic community members go to Google in preference to other internet search engines, the reasons are not easy to identify. The market dominance of Google is clearly one factor. However, the work of Markides (2006) is also useful for understanding user preferences, because Markides identifies the importance of marketing in relation to disruption, and how marketing can prompt disruption, thus potentially destabilising Christensen and Raynor's (2003) core contention, that disruption emerges through practice (though it needs to be recognised that Markides was not writing about Google, but about disruption, as defined by Christensen, as a broader practice). The contradiction can be addressed by recognising that disruption has parameters of possibility; Smagorinsky (2001) constructs a similar argument in relation to the construction of meaning. Academic community members, as subjects in this study, within a second generation activity system, are, themselves, shaped by history, economics and culture, as well as by their individual life circumstances, which are, in turn, shaped, right down to the fundamentals of consciousness itself, as argued by Vygotsky (1930/1998) and Leontiev (1978). Therefore, the contexts experienced by academic community members have a shaping effect on what they do with technologies, but new practices, however prompted, have the potential to change contexts because of the dynamic interaction between practices and contexts. Marketing shapes technology usage, but it is only one of a range of factors influencing practice. Moreover, contradictions can emerge between these factors; historically inherited practices, such as accessing higher education learning materials through academic libraries, can be contradicted by technologies enabling simpler, easier, more convenient access to

learning. Disruption is prompted and structured, rather than the unfettered expression of human creativity. Addressing the specific research question more explicitly, a range of technologies is being used, technologies that are simple, convenient, cheap (or free) and easy to use are more likely to be used, and technologies are being used in arterial and effective ways, as identified in the observations, to accomplish specific tasks.

7.4 Addressing sub-research question 2:

Are disruptive technologies being used to support learning and teaching in higher education in the UK?

This research has argued that disruptive technologies are being used to support learning and teaching in higher education in the UK. For example, academic community members are making more frequent use of Google and Wikipedia than institutional VLEs and academic journal aggregators. This is not to suggest that academic community members are not using institutional, designed for learning technologies, but that their use of institutional technologies is secondary to their use of non-institutional technologies. Disruptive technologies are being used, and being used frequently, as suggested throughout this research, and especially in the final survey.

7.5 Addressing sub-research question 3:

Are users using established technologies in disruptive ways?

The opening surveys for this research showed the participants having high awareness of some technologies (e.g., Wikipedia and Facebook), but low awareness of others (e.g., Delicious and Prezi). Previous research in this general area, as summarised by Manca and Ranieri (2013) suggests social networking technologies (specifically, Facebook) are used in education primarily to support social relationships and social capital (e.g., Ellison, Steinfield and Lampe, 2011). That said, other studies summarised in Manca and Ranieri's account did show Facebook being used for more explicitly educational purposes, such as sharing notes (Bosch, 2009; Fewkes and McCabe, 2012). Interestingly, the same survey by Manca and Ranieri also highlighted a study by Mazman and Usluel (2010) which argued "the factors influencing Facebook users' adoption processes in an educational context rely on a positive relationship with usefulness, ease of use, social conditions, facilitating conditions and community identity, and that among these variables the usefulness dimension is the most important determinant in Facebook adoption" (Manca and Ranieri, 2013, p. 490). This analysis links with the core definition offered by Christensen (1997, p.xv), though Manca and Ranieri do not draw the connection. Factors such as usefulness and ease of use correlate closely with Christensen's definition, suggesting that the conditions for a disruptive technology contribute to the likely

adoption of Facebook for educational purposes. It would seem that academic community members are using popular technologies such as Facebook, but not, this EdD research argues, to support their learning and teaching. Instead, academic community members are more likely to demarcate their uses of technologies, using some to support their social lives and others to support their learning and teaching lives. Technologies such as Facebook may have the potential to be used disruptively, for example by supporting learning and teaching (Bosch, 2009; Fewkes and McCabe, 2012); the technology enables easy networking, and the location of individuals with similar study interests. However, the participants in this EdD research did not use Facebook for that purpose. Instead, the academic community members studied in this research used different technologies in pursuit of different objects, in the activity system sense of purposes. There is evidence of some disruptive use of established technologies, with, for example, Google getting used in preference to academic journal aggregators, but established technologies are not necessarily prone to disruptive use. Instead, academic community members choose different technologies to undertake different tasks. The starting point appears to be the identification, by the academic community member, of a job to be done (what Mazman and Usluel [2010] would define as usefulness), and then the selection of a technology tool to do the job (a choice underpinned by a range of factors, as this research has argued). Using a technology tool used ordinarily for socialising for, instead, learning and teaching, can be problematic for participants, because it blurs lines that participants choose to maintain in order to get jobs done.

7.6 Addressing sub-research question 4:

How is the disruptive use of technologies impacting on higher education in the UK?

The disruptive use of technologies is impacting on higher education in the UK, by, in second generation activity theory terms, creating contradictions between the tools node and the division of labour node. As Scanlon and Issroff's (2005) study showed, participants can assist lecturers in the delivery of technology enhanced learning and, from a Community of Practice perspective, Fuller and Unwin (2004) argued that novices can be more adept in some practices than expert members of the community. Viewing Scanlon and Issroff's research through Fuller and Unwin's Community of Practice lens, novices can enhance learning and teaching through their skills with technologies. Therefore, the disruptive use of technologies has the potential to make aspects of the relationships between lecturers and students more horizontal and less vertical, encouraging collaborative practice and the co-construction of knowledge, rather than the transfer of knowledge from lecturer to student. The disruptive use of technologies highlights the argument that knowledge is constructed, and that learning is a collaborative practice, either explicitly so when learners work together, or implicitly, even when the learner is nominally alone. As Wenger (1998, p. 141) argues, "Our knowing – even of the most

unexceptional kind – is always too big, too rich, too ancient, and too connected for us to be the source of it individually.” This argument is underlined by Smagorinsky (2001, p.163), who states, of readers, “Though alone, they engage in culturally mediated processes, in dialogue with the great history of texts... Though alone, they act in relationship with other readers and readings, participating in communities of practice where social positioning and powerful readings have consequences for others.” The argument is further underlined by Vygotsky (1930/1988) and Leontiev (1977), who argue that consciousness itself is constructed historically and socially, and therefore collaboratively. Knowledge is produced, and produced in contexts which are ultimately social. The use of disruptive technologies amplifies this idea, by showing how meaning arises from practice, and how existing practices influence emerging practices.

7.7 Conclusion

This chapter has used the data gathered, informed by the theoretical frameworks adopted and underpinned by the literature review, to address the main and subsidiary research questions.

Consequently, the following are offered as condensed and abbreviated key points:

- Technologies conforming to Christensen's core criteria for disruption (1997, p.xv) are used widely to support learning and teaching.
- Institutional, designed for learning technologies such as VLEs are more like sustaining technologies (Christensen, 1997), offering improvements in terms of convenience, but not fundamentally changing learning and teaching.
- Academic community members demarcate their technology usage; the study participants were not using social networking technologies, for example, to support their learning and teaching.
- The use of technologies to support learning and teaching in higher education has implications for the academic community, for the division of labour in higher education, for assessment, and for the gatekeeper role of the HEI.
- HEIs can engage constructively with disruptive technologies by recognising that disruptive technologies are used widely by academic community members, and by rethinking technology enhanced learning strategies to accommodate the use of disruptive technologies to support learning and teaching.

CHAPTER 8: CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

The previous chapter discussed the main and sub-research questions, informed by the literature review and by the research. The chapter also presented key findings in abbreviated form. This chapter provides a broader overview of the research, offering overall conclusions and recommendations.

This research set out to investigate how HEIs in the UK can engage constructively with disruptive technologies for learning and teaching. In order to achieve the thesis's aims, a research strategy was designed, comprising seven iterations and lasting for two years. The research recorded both declared and actual practices with technologies to support learning and teaching. The study findings showed that the participants were more likely to use non-institutional technologies than resources provided by their own HEIs. The study also argued that technologies conforming to Christensen's core criteria (1997, p.xv) are more likely to succeed than institutional technologies. In addition, the study findings indicated that the disruptive use of technologies has implications for social relations in learning and teaching in higher education.

8.2 The contribution of this thesis

In addition to the above, the thesis argues that users demarcate their technology usage. The final survey for this research, for example (Phase VI), indicated that participants do not use social networking technologies to any significant extent to support learning and teaching. However, while social networking technologies may not be being used widely to support learning and teaching, and recognising the nuanced position on the use of Facebook summarised by Manco and Ranieri (2013), this thesis argues that technologies such as Google and Wikipedia are being used widely to support learning and teaching, in preference to institutional technologies. The practice of using disruptive technologies has implications for HEIs, because established practices relating to module reading lists and academic libraries are being circumvented by users, who by-pass established, institutional technologies and manage their learning through simple, convenient and easy to use pathways. That said, the final survey showed that most users still perceive their HEI as important in their learning and teaching. It may therefore be the case that the original prompt to learn formally, and the broad direction of that learning (articulated through module and programme learning outcomes) comes, still, from the HEI. This research argues technology use *per se* is characterised by demarcation, and by the use of a narrow range of technologies to undertake a wide range of learning and teaching jobs.

This thesis further argues that the likely success or otherwise of a technology can be evaluated by its conformity or otherwise to Christensen's core criteria for disruptive technologies (1997, p.xv), and, in this regard, the thesis is making an original contribution to the technology enhanced learning debate. However, the predictive capability of Disruptive Innovation has been challenged by Daneels (2006), who points to the failure of the Disruptive Growth Fund, co-founded by Christensen. The Fund gave financial support to disruptive innovations, but closed within a year of commencing, having lost 63% of its value. However, Daneels concedes that it may not be a fair test of the theory, as the Fund was launched "on the very day that the tech bubble was most inflated" (pp.2-3). Elsewhere, Daneels (2004) has critiqued Disruptive Innovation, arguing that it is analysis in hindsight, identifying goods and services that succeeded, and applying Disruptive Innovation theory *a posteriori*. This thesis has not sought to evaluate the predictive potential of Disruptive Innovation theory as a primary aim, but the research does suggest that technologies that conform to Christensen's criteria have shown themselves to be popular in supporting learning and teaching, which has implications for the design of learning technologies. Put plainly, if technologies are simple, easy to use, convenient and free, they are more likely to get used. Disruptive Innovation theory is not predictive explicitly, but Christensen's original formulation of disruptive technologies identifies criteria that have resulted in the successful adoption of technologies by users.

This research is also making an original contribution in relation to work on Disruptive Innovation through the idea of the parameters of innovation. This research argues that disruption is not an unfettered process. Markides (2006) argues it is possible to create disruption consciously through marketing, citing Amazon and Swatch, neither of which generated a new product or commercial service, but both of which changed the way the product or service is experienced by the consumer (p.20). Daneels (2004) also uses Amazon to critique Disruptive Innovation, arguing that Amazon started in the mainstream market, contrary to Christensen's views on how disruptive technologies work. However, while not all innovations that cause disruption need to conform to Christensen's model, his core definition remains useful for identifying factors that make a new technology more likely to succeed within established markets and, more specifically (this research argues), within the higher education sector. This research accepts the modifications of Disruptive Innovation set down by Markides and Daneels, but goes further in suggesting that the limits of disruptive usage are also shaped by broader factors, including history and economics.

This research therefore concludes that all disruption is structured, whether through willful practice as suggested by Markides, or by broader factors. Smagorinsky (2001) argues that meaning is constructed in contexts determined historically, politically and economically. Viewed from an Activity Theory perspective, subjects (users) do not approach tools

(technologies) as a limitless index of possibilities; the meanings they construct for technologies relate to existing, structural features of their contexts. Disruption is not an unfettered expression of creativity, but is, instead, shaped by economic and social forces, which both offer and circumscribe possibilities for usage and which, in addition, are in states of flux themselves. Therefore, the shift from one activity system to another, caused by contradictions within an existing activity system, represents a significant change in possibility; new uses for a technology tool become possible within a new activity system, or, alternatively, new practices with technologies prompt the creation of new activity systems. Consequently, the disruptive practice noted by this research may signify a pressure towards the creation of a new activity system in higher education, in which the use of non-institutional technologies to support learning and teaching becomes more fully accommodated within the higher education sector. This accommodation would involve the acceptance of alternative pathways to knowledge, and will have implications for assessment. Ultimately, Intended Learning Outcomes for modules and programmes may need to reflect the likelihood of a wider range of learning experiences to achieve specific objects.

8.3 The relevance and implications of this research

This research is relevant because it identifies a mismatch between the technologies made available through HEIs, and the technologies used in

practice by academic community members. Therefore, the research holds relevance for strategic decisions made by HEIs in relation to technology-enhanced learning.

The research is also relevant because of the ubiquity of digital technologies in supporting learning and teaching in higher education (Britain and Liber, 2004; Blin and Munro, 2008; Christensen and Eyring, 2011; Kinchin, 2012; UCISA, 2012). Therefore, and in view of the ubiquity of technology, there is a need to use technology tools to their best effect, in order to enhance learning and teaching and in order not to squander the learning and teaching possibilities of technologies. At present, institutional technologies appear underused, relative to the use of non-institutional technologies. This research implies that a strategic approach based on known aspects of practice is more likely to be successful than an approach which starts with the technologies themselves. Indeed, technologies are essentially inert, and attain a purpose only when they are engaged with by users. In Activity Theory terms, subjects (users) are required to interact with tools (technologies) in order to create objects (purposes).

In addition, the research is relevant because it hones in on specific features of technologies that can lead to their success, in terms of take-up by academic community members. Christensen's core criteria for a disruptive technology (cheap, simple, easy-to-use, convenient [Christensen 1997, p.xv]) can be applied by strategy makers to existing and emergent technologies for learning and teaching in higher education, and thus

Christensen's criteria can have a potentially predictive facility, contrary to the argument of Daneels (2004, 2006). Christensen's core criteria succeed often enough to merit being considered when HEIs make strategic decisions about technologies.

The research has the potential to affect the practice of others in education, by influencing the decision making criteria for the introduction of technologies by HEIs to support learning and teaching. The research can also shape practice by exposing and better understanding the relationship between institutional and non-institutional technologies in supporting learning and teaching in higher education in the UK. HEIs may make a plethora of technologies available, but these may not be the technologies of choice for academic community members. By commencing an examination of technology use in higher education with practice, rather than with technologies *per se*, a more compelling narrative emerges to drive technology-enhanced learning strategies at institutional level.

Furthermore, the research can change practice by encouraging consideration of the extent to which technology-enhanced learning can influence social relations within higher education. The use of non-institutional technologies has implications for the division of labour in higher education; students can access materials to support their learning by means other than through their HEI. More provocatively, if the free access to learning materials made available through quotidian technologies such as Google poses a threat to the high-fees offering made available by HEIs, entirely online providers

with minimal institutional library and VLE facilities could pose a threat to established providers. That said, one of the other findings of this research is that students still perceive the HEI as important in their learning and teaching, and the imprimatur of a university can serve to legitimise, both explicitly and symbolically, the learning and teaching that has taken place.

8.4 Limitations and recommendations

This research has argued that academic community members' use of disruptive technologies has implications for higher education. For example, the practice of accessing knowledge resources through Google and Wikipedia, rather than through institutional systems, has implications for the gatekeeper role of the HEI. This thesis argues that the disruptive use of technologies has the potential to change aspects of higher education in the UK.

The thesis draws on Activity Theory and Engeström's (1987) extended model of human activity, the practical application of which requires use of ethnomethodologies to investigate and understand practices in context. However, this thesis's examination of practices of academic community members in UK HEI could not be fully conducted ethnographically due to several factors including: (a) the availability of study participants, shaped by

the academic communities to which the researcher had access; (b) the time limited nature of the present study, which militated against a protracted ethnographic approach; (c) challenges posed in relation to an ethnographic approach by the focus on the use of digital technologies which militated against *in situ* observations and relied instead upon participants' reporting on their practice; and, relatedly, (d) the focus of specific research instruments, especially Phase IV which, in the absence of the opportunity to undertake extensive ethnographic research, set up a structured observation in order to hone in on a specific aspect of practice with technologies to support learning and teaching. Therefore, in order to work effectively with the focused theoretical framework, a phased investigation of academic community members' practices with technology was conducted to gather data and capture the developmental patterns of interactions with technology.

It would have been helpful to have had a larger sample in order to test more fully the ideas presented in this thesis. Furthermore, the sample was drawn primarily from the researcher's network and included a small number of participants who were line managed by the researcher. There is therefore an issue of power relations in the research (Cohen *et al.*, 2000, p.316). In addition, the non-probability convenience sampling approach to the research (Bryman, 2004, p.100) prevents the results from being generalised unproblematically to the UK academic community as a whole. Further research might address these issues through more honed sampling, and further research might also demarcate between different sections of an academic community, in order to investigate the distinctiveness of lecturers' usage of technologies, for example. Different lenses might also have been

applied to the research. For example, Foucault's retrospective definition of *epistemes* (1980) could be used to investigate the limits of Disruptive Innovation, and psychological theories of learning and technology adoption could be used to analyse individual acts of disruptive innovation with technologies. That said, three approaches were used in this thesis, and the use of further perspectives might have complicated the research unduly, and have led to a reductive approach, given the word limit of the thesis.

Regarding the three theoretical approaches, Christensen's work is central to the thesis, by providing a definition of disruptive technologies (Christensen, 1997, p.xv) and through the argument that disruption is a question of practice rather than design (Christensen and Raynor, 2003). Work on activity theory is also important to this thesis, especially because Engeström's second generation activity system (1987) enables an exploration of the impact of disruptive technologies on social relations in higher education in the UK. Moreover, Activity Theory, underpinned by the work of Vygotsky and others, challenges the notion of individual identity and argues that identity is formed by its contexts, including the social and the historical. The argument has implications for the approach of this thesis, which therefore eschews models of technology adoption focused on the individual. Instead, this thesis views practice as necessarily social, which benefits the thesis because it identifies a range of factors contributing to and limiting disruptive innovation, rather than rooting disruptive innovation in the special talents of creative individuals. The process of innovation

therefore becomes more tangible (it is apparent in social relations rather than individual psychology) and thus easier to explore.

The community of practice theory (Lave and Wenger, 1991; Wenger, 1998) tended to recede in importance as the research progressed. Having started out as an important framework in defining an academic community, and with the potential to examine how the use of disruptive technologies shapes progress in an academic community, the theoretical perspective tended to falter in practice, or to get subsumed beneath the other two perspectives, as acknowledged in the introduction to the literature review, which identifies the three approaches used in order of importance (disruptive technology and Disruptive Innovation, Activity Theory, and the community of practice).

This thesis has presented useful findings about practices of UK HEI academic community members with technologies to support learning and teaching in order to question existing sectoral practice and propose a rethinking of technology enhanced learning in higher education, rooted in academic community members' practice with technologies. Whilst the insights produced by this thesis are beneficial to both policy makers and academic community members, a conceptual representation of this knowledge and process would facilitate the adoption and implementation of thesis findings. In this regard, recommendations for future studies in this area would therefore also include the development of a conceptual model of academic community members' practices with disruptive technologies, in order to support implementation of the thesis findings.

8.5 Conclusion

This chapter has offered concluding remarks on disruptive technologies in higher education in the UK, addressing the core research question and evaluating the contribution made by the thesis. In this final section, further suggestions are offered on where this research might lead.

The disruptive use of technologies has implications for assessment in higher education, in instances when students are accessing materials for learning via disruptive technologies, rather than engaging with reading lists supplied by lecturers. If the student is demonstrating attainment of the specified learning outcomes then it is appropriate to credit the learning undertaken, but if the learning is undertaken by non-institutional pathways this may pose a challenge for the HEI. In second generation activity theory terms, a contradiction emerges between the technology node and the rules node, and academic judgements will need to be made in order to address the contradiction. Academic judgement may entail the disregard or relegation of learning undertaken non-institutionally, but a more imaginative approach would be to recognise and encourage the broader channels for learning made available through technology, encouraging and stewarding different pathways, not all of them institutional, for the construction of knowledge. There is a potential for disruptive technologies to enable and evidence more self-directed learning and more autonomy, thereby enhancing the practice of academic communities.

HEIs should recognise that disruptive technology use happens; academic community members are, this research argues, more likely to use Google than an academic journal aggregator, for example. HEIs can choose to ignore the disruptive use of technologies, but, in so doing, they will continue to produce technology enhanced learning strategies on an institutional level which are misaligned with the actual practices of academic community members. Furthermore, if HEIs ignore the disruptive use of technologies they will continue to invest in underused, institutional technologies. Alternatively, HEIs can encourage and support the use of non-institutional technologies, with the aim of making academic community members more adept and informed users of disruptive technologies. More adventurously, HEIs can revisit module and programme aims and intended learning outcomes to recognise, via approaches to assessment, that academic community members may have sources that they use in preference to reading lists. Academic community members could be encouraged to use disruptive technologies to access resources unfamiliar to the module or programme team, thereby exhibiting autonomy and self-direction. A further possibility is to consider how a disruptive technology can be conjoined with or appropriated by an HEI, and thereby comprise a quasi-institutional technology. University You Tube channels are one means by which this can be accomplished, but it will require pedagogical development, rather than simply the relocation of institutional resources to You Tube; the case study of Blin and Munro (2008) showed that the relocation of traditional teaching materials to an online environment did not enhance learning and teaching axiomatically. Thought will need to be given to the deterministic effects of

the medium in order to create effective resources for learning and teaching, but there is scope for enabling disruptive technologies for higher education, recognising the extent and nature of the disruptive technology use that takes place, and examining how it can be accommodated within, and used to enhance, learning and teaching.

The chapter has argued that this research makes an original contribution to technology enhanced learning by arguing that there are parameters, limitations, to innovation, generated by a range of contexts, and therefore innovation is a structured, if not consciously managed, process. Innovation can be managed, according to Markides (2006), but it emerges more commonly and fundamentally through practice (Christensen and Raynor, 2003), whereby purpose emerges, rather than being decreed *a priori* through design. The research also argues for technology enhanced learning strategies based on practice, rather than on the technologies themselves, recognising that technologies have no inviolable, intrinsic purpose, but acquire purpose through human agency (Grint and Woolgar, 1997; Christensen and Raynor, 2003).

Therefore, the challenge to HEIs is to investigate, comprehend and manage the disruptive use of technologies, not merely to safeguard academic standards, but also to identify the disruptive use of technologies as an opportunity to enhance learning and teaching. This latter, and bolder, step involves recognition of the potential of disruptive technology use, seeing it not as something to be contained (see Sharples, 2002), but as something to

work with in partnership with academic community members, for the betterment of learning and teaching. Scanlon and Issroff (2005) provide an isolated example of this practice, with students helping a lecturer to use technologies in class, but a more strategic approach is required for institutional change. Disruptive technologies can be enabled by individuals, and by networks, but intervention is required to enable disruptive technologies on an institutional level, through institutional technology-enhanced learning strategies that recognise and accommodate the use of disruptive technologies to support learning and teaching. There is a case for supporting academic community members in their uses of disruptive technologies, in order to reconcile institutional practices with non-institutional technology use.

Consequently, the thesis offers specific, condensed recommendations:

- The production of technology enhanced learning strategies based on practice rather than on technologies.
- The rethinking of institutional technologies, to see if they can be reconfigured in order to have some or all of the qualities outlined in Christensen's core definition of disruptive technologies (1997, p.xv).
- The welcoming of innovative practice by academic community members, seeking to accommodate innovation within, rather than exclude it from, learning and teaching.

In terms of personal and professional development, I started out with Christensen's dualism between sustaining and disruptive technologies. I took the view that HEI's VLEs were sustaining technologies, relocating the component parts of face-to-face teaching online, but without due consideration of the deterministic impact of the medium. I also assumed that disruptive technologies were the most interesting, as they draw upon human creativity to create new possibilities for learning and teaching. In addition to Christensen's work, I was interested in Huizinga's argument that play is a feature of human nature, something human beings do instinctively, and that play turns to seriousness, and hence simply experimenting with new technologies can lead over time to their adoption into formal practice (1938/1971). I was also interested in Rodriguez's argument that play can be a purpose of learning with technologies, comprising intrinsically satisfying learning in itself (2006). However, undertaking the research has resulted in me now taking the view that possibilities for disruption are themselves structured and circumscribed, in line with the position taken by Smagorinsky (2001), whereby meaning is constructed from the prevailing economic and historical conditions, creating epistemological limits, and limits of practice. This argument is underlined by Vygotsky (1930/1998) and Leontiev (1977) in their view of how consciousness itself is constructed. Each activity system, under the pressure of its own internal contradictions, creates possibilities for disruption, but once those disruptions threaten the activity system they will either be suppressed (Sharples, 2002), or understood without the need for further action (Benson and Whitworth, 2007), or a new activity system will emerge in which the disruptive form of

practice is accommodated. That activity system will, in turn, produce its own inner contradictions leading, again, to new forms of practice in an unending dialectic. Put another way, and building from the arguments of Vygotsky (1930/1998) and Leontiev (1977) through to Christensen's work (1997, 2003), there is a palimpsest quality to human subjects, and practice brings forth aspects of historically-shaped creativity and thus repositions consciousness. When a network of innovative users is formed it can cause disruptions, and then institutions respond to disruption, either through exclusion, or with accommodation.

More broadly, in the UK, we are not, at present, engaging constructively and fulsomely with disruptive technologies. Instead, we invest in underused institutional systems. We can be confident that academic community members make plentiful use of disruptive technologies, but don't build that knowledge into strategies. We posit a hypothetical student who discusses issues on VLE forums and does their research *via* an academic journal aggregator, but it seems that actual learners are more likely to use VLEs as content repositories (Blin and Munro, 2008; Conole *et al.*, 2008; Fry and Love, 2011) and undertake their research on Google and Wikipedia. If, conversely, we look at what academic community members do, rather than what we'd like them to do, we will have a firmer evidence base from which to construct technology enhanced learning strategies, and an enhanced knowledge of actual practices with technologies to support learning and teaching, which can then comprise an influence on the kind of modules and programmes we design, the assessment methodologies we design for

programmes and modules, and on the way we structure and support learning in academic communities. Higher education in the UK may benefit from new activity systems, in which the division of labour is reconsidered, to accommodate and manage the presence of disruptive technologies supporting learning and teaching. We need a little more disruptive behaviour.

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Appendix I – pilot study survey, November 2010 – March 2011

Survey 1

Question 1. In the table below, please indicate, by ticking 'yes' or 'no', whether you have heard of the technologies listed. If you have heard and of the technology and have also used it, please put a tick in the third column.

	Yes	No	Have used
Bebo			
Blackboard Web CT Virtual Learning Environment			
Del.icio.us			
Facebook			
LinkedIn			
Moodle Virtual Learning Environment			
MySpace			
Other Virtual Learning Environment (please state name below)			
Prezi			
Twitter			
Wallwisher			
Wikipedia			
Xtranormal			

Question 2. In the table below, please indicate how you have used the technologies. Feel free to tick more than one box for each technology, if applicable. If it is a technology you have not used, please leave that row blank. By ‘formal learning’ I mean learning in the context of a course at a Higher Education Institution (HEI). By informal learning I mean learning not related to a course at an HEI.

	Work	Recreation	Formal Learning	Informal Learning
Bebo				
Blackboard Web CT				
Del.icio.us				
Facebook				
LinkedIn				
Moodle				
MySpace				
Other Virtual Learning Environment				
Prezi				
Twitter				
Wallwisher				
Wikipedia				
Xtranormal				

Question 3. What are the main technologies you use for work (for this and the subsequent questions, ‘technology’ refers to any application mediated through a computer terminal, laptop, or handheld device)? List up to three, in rank order.

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Question 4. What are the main technologies you use for recreation? List up to three, in rank order.

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Question 5. What are the main technologies you use for learning (formal or informal)? List up to three, in rank order.

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Question 6. Do you use any technologies, other than Word or other word-processing software, to help you research and/or write work that you submit for formal assessment? If so, please list the technologies here.

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Question 7. Are there any technologies that you have only started to use since you started studying with a Higher Education Institution? If so, please list them here.

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Question 8. If there are any other technologies that you have used to support learning, formal or informal, other than those listed in the tables above, please write them down here.

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Question 9: Can you briefly explain how you use the technologies that you selected in the above table (Q2)? What do you use them for?

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Question 10: What are the advantages and disadvantages of using these technologies in your teaching or learning activities?

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If you would like to make any further comments, please use the rest of this page. Thank you for completing this questionnaire.

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Appendix II – sample interview (Phase I), February 2011

Interview with [name of participant]

Friday 11 Feb 2011

Michael Flavin: When do you think you first started to use technologies to support Learning and Teaching; by technologies meaning things that you access online?

Name: For myself it was when I did my post grad courses.

Michael Flavin: When was that?

Name: I knew you were going to ask me that. About five years ago I guess. [Name of HEI] had a mechanism by which you logged-online and you were able to engage with your cohort. So you would have a case study online and then you would put all of your comments about how you would deal with your case study, then review their comments and then adapt and move on, and you would actually get assessed on that as well as on your contributions. So that was my own learning and teaching, with regards to using technologies in learning and teaching with the [name of HEI], that's really with the instigation of the forum process and that's primarily the discussion to allow reflective learning.

Michael Flavin: To start with you as a student rather than as a lecturer, what training and induction did you have at [name of HEI] in using the technology?

Name None.

Michael Favin: How did you figure out how to use it?

Name It was not easily navigable. We all complained in the next session. We went in and said where is it, how do you get to this. We were constantly ringing each other up, and I think it was a measure of how motivated we all were that we did actually bother to call each other up and email and say, I've happened across this tab which then gives you a link to the next bit and then you can get to the case study. But we weren't given any direction and in the next session we actually gave feedback and said we would prefer this addressed for future cohorts that you are given a little learning pack about where you go, so you can navigate it.

Michael Flavin: It's hypothetical, but do you think if you had that more formal induction process, do you think that would have enabled you to use the system more efficiently?

Name: In terms of time - yes and therefore in terms of volume of contribution, because you are time bound anyway how much you are actually going to input.

Michael Flavin: As for the networking you did by email and phone in order to use the system with fellow learners, how effective was that as a learning process in itself - so the learning to learn you did as a network?

Name: I think that was highly valuable - not in terms of how we used necessarily the system because that seemed more ad hoc. If you're talking about the fact that we emailed each other, kept each other motivated, then yes that's highly valuable because you actually had that sense of identity and I'm still in dialogue with a couple of people from that course.

Michael Flavin: So you as a lecturer then; what sort of training and induction did you get in how to use the systems you use as a lecturer?

Name Again – none to start with. As we've gone on and as the system has progressed, then we've had contributions from the learning and teaching and support team who have said this is how you can do it and then Sam has been very good about sending out materials and support. But initially there wasn't that introduction to it. It's been a subsequent process.

Michael Flavin: So how did you figure out how to use it in the absence of instruction?

Name With the forums it's fairly instinctive - there's nothing too problematic about it. What I think has been a useful contribution along the

way has been when we have been given guidance about how we can progress it and further it. So it is very easy to use as a basic tool, but if you actually want to get your students to be more analytical rather than just straight knowledge transfer, then that's been useful to have a little background information from Sam saying okay you can pose these types of questions.

Michael Flavin: Do you think technology has changed the way you interact with students?

Name Yes, it necessarily has. Because they are more aware of it, they're expecting that alternative delivery channel. What I find interesting with the part-timers, because they are in a professional environment, they're used to using Blackberry's, they're used to the email process and I don't think that will necessarily be the case with the full-timers. So my [name of HEI] cohort are very used to me interacting with them via U Learn. So I can post up an announcement, I can flag up if there is a particular message as we go through as well. So I've been doing that now for a year and a half and using U Learn as the tool. We have messages, we have announcements, I can post all of the materials online, they can send me materials. When they send me links to things, they tend to, ironically, email me and say that I've just found this on the web, I then cast my eyes over it and load it up onto U Learn for the rest of the class to consider.

Michael Flavin: Can we just pin that one down a second? So you also lecture at The [name of HEI] and sometimes a student will approach you saying I've found this learning resource and are they then looking for you to kind of give some kind of quality assurance statement on that? Or have you actually set-up a protocol that they have get referred to you, rather than just get posted up by the student?

Name They are not able to load anything up onto U Learn themselves. It's physically not possible. I've always given them the exclusion clause because websites change regularly and you just don't know what might pop-up on a website as an advert or something. They know that there is this general exclusion clause, that I am not approving the website, but if there is an article, and it's usually a news article from the Telegraph or the Banker or something like that, they are just saying that they think that it would be a useful supplement to what we were discussing last week - I think it has resonance. Then I load it up onto U Learn and ask the rest of the group to comment.

Michael Flavin: Instead of all the learning and teaching resources at the [name of HEI] coming from you – some of them maybe posted by you, but essentially coming from the students. How do you feel about that?

Name I think it's absolutely brilliant because they're engaging in that process. And they're not just waiting to be spoon fed. They're actually actively seeking materials and they're sharing it with everyone else. I think

the reassurance, not necessarily from a quality issue, is the reassurance - yes this is exactly what we were talking about – because they don't have that practitioner experience. They are reading an article and thinking, well that's something we talked about last week or three weeks ago, and they really want me to turn around and say yes, that's exactly what, or partly what we were discussing, but it continues in that direction.

Michael Flavin: If you're seeking out information to support your own learning and teaching, where do you go?

Name I go on the KnowledgeBank

Michael Flavin: That is the proprietorial system of the [name of HEI] – the journal aggregator.

Name I go through the Banker. I go through the Chartered Institute of Personnel and Development website and then it's the good old Google as well. But because we have access through KnowledgeBank to EBSCO etc, we do actually have that opportunity to scan through their academic articles as well.

Michael Flavin: Are you on any social networking sites like Facebook or Twitter

Name I'm not on Facebook, I'm not on Twitter, but I am on LinkedIn because that's rather professional

Michael Flavin: LinkedIn is a good example. What do you use LinkedIn for?

Name I started that last August and I'm not even sure why I started that. Something was talking about LinkedIn and I thought I would go in and have a look. I thought it was a good idea to actually go and find out, particularly if I was going to do some research to find out who else out there might be conducting some research in that area. I haven't used it to its fullest extent by any stretch of the imagination. What I find difficult about that is knowing, when you were talking about quality assurance earlier, that really does touch on my problem with LinkedIn; you keep on getting these invites for other people to join your site and I start thinking well I don't know who they are, I'm not sure that I want to have that person and so you then want to track it back because you just don't want to have too many people on there.

Michael Flavin: Are you conscious on LinkedIn – Is it just about maintaining an online professional identity? With whom have you networked with on LinkedIn? How many people are you connected to?

Name: There's probably only about ten.

Michael Flavin: And who are they?

Name: A couple of domestics and quite a few with the [name of HEI].

Michael Flavin: Domestics meaning personal acquaintances?

Name: Personal acquaintances where they have turned round and said I've spotted you are on LinkedIn. And I think they connect via the email; if you're on outlook I think there is a link there and they pick them up if there is an email connection. I can't see how else they would pick me up.

Michael Flavin: Have you had contact with any of these domestic contacts facilitated by LinkedIn?

Name: Yes

Michael Flavin: And the fact that nominally it declares itself as a professional networking space, for you there is no awkwardness with using it just for more orthodox social networking?

Name: No, there isn't actually. An interesting point because with the two people I am connected with, one is a violin teacher, so with my children, it's quite useful as I then get links to further professional contacts with her, in fact have tracked down a violin shop. So that has been a useful connect

which I probably wouldn't have had that discussion with her if I hadn't seen who else she was linked in with.

Michael Flavin: So that particular stockist that you use for your childrens music, you probably wouldn't have encountered had it not been for the LinkedIn

Name: I wouldn't have had that conversation as I don't meet with her personally.

Michael Flavin: Is there anything further that you would like to add?

Name: No

----- INTERVIEW ENDS -----

Appendix III – second survey, October – December 2011

Survey 2

Question 1. In the table below, please indicate, by ticking ‘yes’ or ‘no’, whether you have heard of the technologies listed. If you have heard of the technology and have also used it, please put a tick in the third column.

	Yes	No	Have used
Bebo			
Delicious			
Dictionary.com			
Elluminate			
Facebook			
Flickr			
LinkedIn			
MySpace			
Prezi			
Second Life			
Skype			
Survey Monkey			
Twitter			
Wallwisher			
Wikipedia			
Wordle			

Xtranormal			
You Tube			

Question 2. In the table below, please indicate how you have used the technologies. Feel free to tick more than one box for each technology, if applicable. If it is a technology you have not used, please leave that row blank. By ‘formal learning’ I mean learning in the context of a course at a Higher Education Institution (HEI). By informal learning I mean learning not related to a course at an HEI.

	Work	Recreation	Formal Learning	Informal Learning
Bebo				
Delicious				
Dictionary.com				
Elluminate				
Facebook				
Flickr				
LinkedIn				
Moodle				
MySpace				
Prezi				
Second Life				
Skype				

Survey Monkey				
Twitter				
Wallwisher				
Wikipedia				
Wordle				
Xtranormal				
You Tube				

Question 3. Have you used Virtual Learning Environments to support your studies? If so, can you remember the names of the Virtual learning Environments you have used? Please list them.

Question 4. Have you used Virtual Learning Environments to have social conversations with other learners or with lecturers? If so, please list the Virtual Learning Environments you have used for this purpose.

Question 5. Have you ever introduced another learner or tutor to a technology (for this and the subsequent questions, ‘technology’ refers to any

application mediated through a computer terminal, laptop, or handheld device) to support learning and/or teaching? If so, please list the technology/technologies here (up to three).

Question 6. What are the main technologies you use for work? List up to three, in rank order.

Question 7. What are the main technologies you use for recreation? List up to three, in rank order.

Question 8. What are the main technologies you use for learning (formal or informal)? List up to three, in rank order.

Question 9. What are the main technologies you use to support learning and teaching when you are not actually in a classroom? List up to three, in rank order.

Question 10. Have you ever tried to use specific technologies to support learning and teaching, but have found them to be unworkable, impractical or otherwise not fit for purpose? List up to three, in rank order.

Question 11. If there are any other technologies that you have used to support learning, formal or informal, other than those listed in the tables above, please write them down here.

If you would like to make any further comments, please use the rest of this page. Thank you for completing this questionnaire.

Appendix IV – sample interview (second interview, Phase III), November 2011

Interview with [name of participant] (part 2, Nov. 2011)

Michael Flavin: When we spoke before back in February you mentioned Linked In as a technology you use. Have you been using Linked In since we spoke in February?

Name: Yes – because back in February I probably had about 20 connections, fairly small. Since then it hasn't grown hugely, so I think we're getting into the upper fifties, but yes I have been using it more regularly. I'd say I probably go onto Linked In at least once a week, possibly more than that.

Michael Flavin: Do you have any sense of why your use of Linked In has increased in the last nine months or so?

Name: Primarily because the emails – what's happening is you get the email prompts back when there is updates on other members. So that then makes you think okay let's go and see what they are doing. And also I've discovered that because my surname is fairly unusual I'm being tracked to get in contact with other members, primarily my husband. So all his ex-university pals are contacting me to say is Steve on Linked In. So again, once you're

in there to respond to them, you then start following who they know also and getting connected with them.

Michael Flavin: So in some senses you think that your use of Linked In is changing over time?

Name: It's becoming quite social in terms of the updates, which I wasn't aware of before, and I'm not sure if they were in the situation. But people seem to be updating their profiles more readily. They seem to be doing more connections to Twitter etc and saying okay well I've come across this particular conference which is of interest to me, or this particular website, or I'm being involved in this event and consequently you are being drawn more into that community as a consequence of that.

Michael Flavin: Do you think you are using Linked In to support your own learning and teaching in any way?

Name: Yes, because there's about four contacts that I am now approaching as a consequence of work. And I've discovered that they are actually involved in education. So people that I didn't know were involved in education, I've now connected to them. So we're beginning to have some dialogues about assessment methodologies etc.

Michael Flavin: Have you started to use any new technologies since we spoke in February?

Name: I've started using Delicious, which has started to become a little obsessive in terms of I use for both work, my own research and also for organizing family tags etc. So in fact the whole family now use Delicious as a way of recording URL's that they've been interested in and when they're doing research. So typically if the family have got homework in a particular topic area, they're now coming up with a tag for that particular topic area and they're using it. So Delicious is now going through the high school as well.

Michael Flavin: Delicious was a technology that you and I looked at when we were interviewing in February. Was it something that you started using straight away after that first interview, would you say it has been a straight away thing, or more incremental and gradual thing? Would you say that the way you have used it has been changing in recent months?

Name: I think it was a fairly rapid adoption. I wouldn't call myself somebody who was naturally proficient in technology, but it was very much an instinctive environment. Where I got thrown was about a month ago they changed the way you actually log-on and there was a panic moment when I thought all of my tags had gone. Of course when you then start researching, you can see the log of people who are having the same problem in the community. So you sort of put your mind at rest that they would all come back and sure enough it did. But the fact that it looks different when you first log in and they start coming up with different terms just amuses

you to start with, and unfortunately the cynic in me turns, means that I kind of switch off for a bit and go oh don't change it yet again. Because it wasn't explained and you had to research about why these changes were happening. But it's sort of gone back to normal now and I can understand the benefits of bringing other links in. But I don't use it for those purposes.

Michael Flavin: So in summary, how do you feel about the fact – I know what you mean, it happened to my account too – in summary how do you feel about the fact that it changed about a month ago? How do you manage change in that technology?

Name: It's just trial and error. It was aggravating because it changed and it didn't look like it did. It wasn't so much the fact that it looked different I guess. It was more along the terms that it didn't have the functionality that it had previously had - for about a week. And once the functionality came back I was then in a situation where I felt, well okay let's try and discover what has changed and I started finding out what they had developed and why it had occurred.

Michael Flavin: Do you think it is better or worse for the fact that it has changed?

Name: I think it is better overall. It's opened my eyes to what other possibilities are out there, even if I haven't yet gone down that route. Because I don't necessarily want to make any of my tags available publicly.

Michael Flavin: Do you use it to support your own learning and teaching?

Name: Definitely.

Michael Flavin: Could you elaborate on how you use it to support your own learning and teaching?

Name: I tend to use Google as a search engine. So if I've got a topic that I'm going to be teaching the next week, I always like to bring in something that is contemporary, and so I have tags for research in law, in management or human resource management specifically. And then once I have gone through that basically I will pop that down into the Delicious, so I've always got that as a permanent record, rather than trying to convert a file into a PDF or a Word document and saving it on my docs.

Michael Flavin: You are currently teaching full-time on campus students in the 18-21 age group, is that a new development for you?

Name: Yes it's a new development. It started back on 26 September, so I'm currently in week three.

Michael Flavin: How in your view is this specific group of learners using technologies to support their learning?

Name: They have got access to our own [name of HEI] virtual learning environment. Some of them have been fairly swift to embrace that. Others still have not logged-on, which is a concern as even in the induction week we showed them how to do it. Subsequently each and every Lecturer has actually gone into the VLE and shown them how to access all the materials. So some are not as technologically proficient as we thought they would be. Others are extremely adept. We did some presentations earlier this week, they were quite happy hyper linking to You Tube and other sites. Similarly they are quite happy to sit down and work with their own laptops or iPads and conduct research there – in fact they prefer to do that than rifle through the core text, even when you tell them that the information is there in the core text. They instinctively jump onto what they are more familiar with. They are quite happily researching.

Michael Flavin: How do you feel about them using online technologies, laptops, tablet computers in the classroom?

Name: I've no problem with that whatsoever in terms of if I'm setting them a task to take notes. That's absolutely fine. I've got one student who has actually asked whether he can record the lectures. I don't know whether that is because of a learning difficulty, or whether that is just his preferred way of trying to memorizing what has been said. The only issue I do have is I reserve the right that if they start texting or emailing, I turn around and say no that's not helping assisting with the learning. It becomes a barrier. I do think we have to be alive to the fact that it can sometimes be a

distraction. So as long as it has something to do with the subject that you're teaching, I have no problem with it whatsoever.

Michael Flavin: Are there circumstances where you do prohibit or would prohibit the use of these online technologies in the classroom?

Name: Yes. If I was giving a lecture - a PowerPoint presentation, the only reason why I would expect them to have their net books or laptops open is if they are taking notes – that would be fine. But what I don't want to do is see a sea of heads in front of me where they have all got their heads down tapping away and I don't necessarily know what they are doing. So I feel slightly uncomfortable about that. So I need to be comfortable that they are actually taking notes rather than doing a game or something different.

Michael Flavin: Think about when students submit work for assessment. If in their list of references or in the main body, it is clear that they have used sources that they have found for themselves i.e. not ones that you have recommended or not ones that feature on a reading list, how do you feel about that?

Name: It's absolutely brilliant. If they have gone elsewhere and found their own research sources, that's something that I would encourage and I do encourage. Every week I suggest to them to look outside and conduct their own research. And I also have a Wiki where they basically have their own student learning resources there and then connecting so they're downloading

resources that they have come across, if they want to, so that others have access to that as well.

Michael Flavin: So this is a Wiki whereby people list the resources that they have found so the cohort have access to the same information?

Name: Precisely.

Michael Flavin: Do you give them any guidance as to the value of sources – such as saying if it has an edu or ac.uk suffix it's a university? Or do you just give them free reign to find what they want to find?

Name: I give them free reign, but it's a good point. I haven't given them that guidance. There is going to be an academic writing skills course, which is next week and I'm not sure whether that will actually be covered there. So I suppose that might be worth flagging up.

Michael Flavin: Is there anything else that you would like to add?

Name: No that's fine.

Appendix V – example of observation (Phase IV), November 2011

Observation study, 07/11/11

Subject: [participant]

As session starts, subject states if she were on campus she would go to library catalogue, and take books from shelves.

10:39 Goes to institution Home Page. Enters 'widening participation in HE' in search box at top right of screen.

Results come up via Bing.

Subject gets off Bing and goes to Google.

10:40 Searches 'widening participation in HE'

Clicks link, Dept for Employment and Learning.

Clicks on Widening Participation page.

10:41 Studies page.

10:42 Back to results page.

Clicks HEFCE link.

Studies page.

10:43 Clicks link at bottom of page; 'A-Z of widening participation pages.'

Clicks on link, 'lifelong learning networks.'

Studies page.

Clicks on link, 'Aim Higher'.

Back to HEFCE page.

Clicks on 'widening participation' tab.

Back to HEFCE page.

10:44 Clicks on 'widening participation strategic assessments'.

Studies page.

Clicks on FAQs.

Studies page.

10:45 Uses pen and paper to write down web page title.

Opens blank Word doc..

Types 'References'.

Copies link to Word doc.. Types 'HEFCE' next to link.

10:46 Clicks back to FAQs.

Back to HEFCE page.

Clicks on Widening Participation.

Clicks link in left-hand margin: 'The new university challenge'.

Studies page.

10:47 Back to Google.

Search term, QAA.

Clicks on QAA link.

Enters 'widening participation' in QAA search box.

Studies page.

10:48 Clicks on link, 'HE in FE colleges'.

Studies page.

10:49 Clicks on link, 'Outcomes from institutional audit'.

Studies page.

10:50 Back to QAA page.

Back to Google.

Pauses.

Search terms: 'widening participation agenda'.

10:51 Clicks on 3rd link, 'Learning for the twenty-first century (lifelonglearning.co.uk).

Back to results page.

Clicks on second link, Journal of Widening Participation and Lifelong Learning'.

Scrolls up and down page.

Clicks link for journal url.

10:52 Copies url to Word doc..

Back to journal page.

Clicks link for most recent edition (August 2011).

10:53 Page slow to load; clicks again.

Page fails to load.

10:54 Back to journal home page.

Clicks link to Open University page, 'the centre for inclusion and curriculum' (?).

10:55 Back to Google results page.

Clicks on pdf link, 'widening participation: overview and commentary' (HEA document).

Studies doc..

10:56 Back to Google.

Search terms, 'The future of HE'.

Clicks on first link, 'White Paper on the future of HE' (leeds.ac.uk).

10:57 Clicks on 'Download a copy of the White Paper'.

Opens White Paper, 'Students at the heart of the sytem'.

Studies doc..

10:58 Copies link to Word doc..

Study ends.

I confirm this is a true and accurate record of the observation study.

Subject: [Name of participant]

Date:15/11/11

Researcher: M Flavin

Date: 15/11/11

Appendix VI – structured interview (Phase V)

Interview with lecturer – Thursday 19 January 2012

Michael Flavin: Have you had formal training in learning technologies? If yes, can you tell me about this training?

Lecturer: I've had some training in Podcasting and I've been walked around the KnowledgeBank system [academic journal aggregator], but otherwise I would normally say no. Most of my training has been informal. I've taught myself PowerPoint and taught myself other programmes that I use within the computer and within my teaching, but I haven't been formally taught them.

Michael Flavin: Can you summarise any informal training you have had in the use of learning technologies (for example, a colleague or friend showing you how to use a particular technology)?

Lecturer: I'm sure there must be examples of colleagues and friends showing me things, but I just can't think of any. I think because I work at home and on my own, I'm very much self-taught. I may ring someone up and say I'm on PowerPoint and I don't know what to do with the next bit. So I might get some help over the phone, which would be quite informal, but I don't have sessions with somebody down, even informally with a friend, I tend to work it out for myself.

Michael Flavin: To what extent would you describe yourself as self-taught in your use of learning technologies?

Lecturer: Probably about eighty to ninety percent self-taught.

Michael Flavin: Has one of your students ever introduced you to a new technology?

Lecturer: No, not that I can recall.

Michael Flavin: Which social networking services (e.g., Facebook, Twitter, LinkedIn) do you use, if any?

Lecturer: I use Linked In and Facebook, and I'm registered with Twitter, but I don't tend to use it.

Michael Flavin: What do you use them for?

Lecturer: Social reasons for Facebook and Linked In very much for work. I find that I don't approach my students, but if they approach me to join their networks, then I'm happy to do that.

Michael Flavin: Are there any specific online technologies that you have started to use within the last twelve months? If so, are there any specific reasons for why you have started to use them?

Lecturer: The two I've just mentioned, Facebook and Linked In, I've only just started to use in the last twelve months. Facebook was very much social as a group of friends used it and it just seemed a nice social thing to do. Linked In I use because I thought it would be useful to increase my

profile. I also thought it would be quite good workwise to do that. I've started to use Delicious after you showed it to me, so I'm starting to note things on Delicious, which I find useful. And I've had a quick look at Word Press, but I haven't done anything with it. But thinking about the blog that I wanted to run, I've had a quick look around that.

Michael Flavin: Are there any specific online technologies that you have used more frequently within the last twelve months? If so, are there any specific reasons for the increased usage?

Lecturer: Probably the ones I've just mentioned. Facebook, Delicious and Linked In.

Michael Flavin: Are there any specific online technologies that you use for both learning and recreation?

Lecturer: Yes – Delicious. Probably nothing else. Linked In I see as my working life and Facebook as my social life.

Michael Flavin: Are there circumstances in which you would prohibit the use of the internet in the classroom?

Lecturer: No. I can't think of any circumstances in which I would. I think the students I teach know what the boundaries would be. Possibly if I was in a different environment I may have to, but not in the environment I teach.

Michael Flavin: As a Lecturer, in your opinion, where do students get the resources they use for assessed work?

Lecturer: Google. Definitely some sort of Internet search engine. Rarely from *KnowledgeBank*, unless they are directed. In my workshop yesterday there were three pieces of reading that was recommended for the assignment. So I directed them to that and said read those and have a look and if you want to reference them they are already referenced for you, so you know what to do. But I suspect normally most of it is Google – in fact I know most of it is Google.

Michael Flavin: Do you use different technologies for different purposes, e.g., certain technologies to support your learning, and other technologies to support your social life?

Lecturer: Yes. I'm increasingly using Google Scholar for work life, whereas I would usually just go to Google for anything else. I do try to use *KnowledgeBank*, but I don't find it as user friendly as I find Google.

Michael Flavin: Do you use Wikipedia? If so, what do you use it for?

Lecturer: I do use Wikipedia as a springboard to look for other things. So if I've found something on Wikipedia, I might look for the links that they have used and then start researching the references and the books that the original author in Wikipedia has used.

Michael Flavin: Do you use Twitter? If so, what do you use it for?

Lecturer: I'm registered with Twitter, but I don't really use it.

Michael Flavin: Do you use Facebook? If so, what do you use it for?

Lecturer: Yes I do for social networking.

Michael Flavin: Do you use LinkedIn? If so, what do you use it for?

Lecturer: Linked In is mainly just a profile for me. I haven't finished updating all of the fine points that you can do on it. But I think that my students quite like to see me on there. I get quite a lot of requests from students, so it's mainly a student presence, just so they have got somebody that they can add to their network to support them rather than to support me.

Michael Flavin: Do you use a Virtual Learning Environment at a university or other Higher Education Institution? If so, what do you use it for?

Lecturer: Yes I do within my student cohort. I use the [name of HEI's VLE]. I use it mainly as a bulletin board and for posting articles or directions and study guides and tips. It's just information that I want to give to my students.

Michael Flavin: Anything else that you would like to tell me?

Lecturer: I still don't feel that I'm as adept with the Internet as I could be. And I would like to learn more, but I find that because I'm mostly self-taught it's knowing where to go for the information to use more. I'm massively impressed with the way that you find things with search engines, when I just can't find it.

Appendix VII – final survey (Phase VI)

Do you use Google to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

3. Do you use Google Scholar to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

4. Do you use a search engine other than Google or Google Scholar to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

5. Do you use an academic journal aggregator (e.g., Academic Search Complete) supplied by your Higher Education Institution (H.E.I.) to support

your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

6. Do you use Wikipedia to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

7. Do you use any other online encyclopaedia to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

8. Do you use a printed encyclopaedia to support your learning and/or teaching?

- ☐ Always
- ☐ Frequently
- ☐ Sometimes
- ☐ rarely

- ☐ Never

9. How often do you use a Higher Education Institution Virtual Learning Environment to support your learning and teaching?

- ☐ Every day
- ☐ Most days
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

10. How often do you visit a physical library to support your learning and/or teaching?

- ☐ Every day
- ☐ Most days
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

11. On the occasions when you use a search engine to support your learning and/or teaching, how many pages of results do you consult for each search, on average?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ More than 4

12. Do you use Facebook to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

13. Do you use Twitter to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

14. Do you use LinkedIn to support your learning and/or teaching?

- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

15. Do you use YouTube to support your learning and/or teaching?

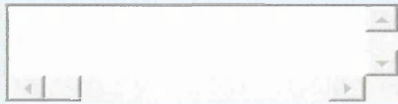
- ☐ Frequently
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

16. Do you use any other digital technologies to support your

learning and/or teaching (cite up to 5)?

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17. When you are looking for information to support your learning and/or teaching, where do you normally look (cite up to 5 sources, in order of frequency of use)?

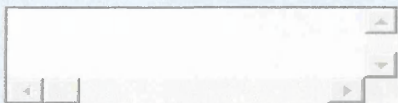
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18. How important are the following qualities to you when it comes to using technologies to support learning and/or teaching (rate out of ten)?

The physical size of the technology

The simplicity of the technology

The cost of the technology

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19. To what extent do you rely on your Higher Education Institution for accessing materials to support your learning and teaching?

- Overwhelmingly
- Largely
- To some extent
- Not very much
- Not at all

20. What is your current, primary role in higher education?

- Lecturer/tutor
- Student
- Academic-related staff
- Other (*please specify*):

Appendix VIII – information for participants sheet

INFORMATION SHEET.

Dear ----,

You are invited to take part in a research study; ‘Enabling Disruptive Technologies for Higher Education Learning and Teaching.’ Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.

The purpose of the research is to explore the use of technologies to support learning and teaching in Higher Education. In particular, the study is interested in the use of ‘disruptive technologies,’ meaning technologies that are not designed explicitly for education, yet which have, in practice, the potential to enhance learning and teaching.

You have been invited to participate because you are currently studying at or working in a Higher Education Institution.

If you choose to participate you will be asked to complete a questionnaire. I envisage it will take you considerably less than one hour to complete the questionnaire.

The study as a whole is designed to further our understanding of the uses of technologies in learning, and to recognise the learning and teaching value of technologies that people use in their day-to-day lives.

The results of the research will appear in work submitted towards a Professional Doctorate in Education (EdD). The results may also feature in subsequent published research. It is anticipated that the research will be completed in 2013. A copy of the final research can be made available to you on request.

Any information collected about you during the research will be strictly confidential. Your name and any other identifying details will never be revealed in any publication of the results of this study. You are free to withdraw from the research at any time without explanation, and with no penalty.

If you would like to participate in this study then please complete the consent statement on p.2 and return this document to me at m.flavin@open.ac.uk.

Please do not hesitate to contact me if you would like any further information.

Thank you for taking time to read this information sheet.

Michael Flavin, October 2011.

CONSENT FORM

Tick box

1.	I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.	
2.	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	
3.	I understand that my responses will be kept anonymous.	
4.	I agree to take part in the above study.	

Name of participant

Date

Name of Researcher

Date